

# SCIENCE

FRIDAY, JANUARY 31, 1913

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## THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE COMPARATIVE MEASUREMENTS OF THE CHANGING COST OF LIVING<sup>1</sup>

THE changing cost of living is a fundamental cause of many reactions in the complexes of social phenomena. In fact, it is probable that an economic interpretation of many important historical movements may be developed from future study of such events as possible effects of this probable fundamental cause of radical movements in human societies, such as extensive revolutions and even international wars.

Political economists, at any rate, should hold always before them the idea that mankind is subject first to the primary economic problems of self-maintenance. The changing cost of living is another phrase to denote in a civilized society this factor of relative self-maintenance which is so important in the study of the more primitive societies. Thus, on the side of the consumption of commodities, we may measure the changing cost of the primary necessities in terms of the prices of the markets.

With the development of markets and with the establishing of standard grades for leading commodities, it becomes possible to fix rather definitely comparative prices of all of the more important commodities. As a result, we may compare with a considerable degree of accuracy the fluctuations in the changing cost of living over a series of successive years. Of course, the greater problem of constructing an index number of relative welfare which shall

<sup>1</sup> Address of the vice-president and chairman of Section I, American Association for the Advancement of Science, Cleveland, January 3, 1913.

combine in some rational way the general concepts of the cost of living and of the average rates of income may lead eventually to many interesting conclusions, but this problem at the present time is extremely difficult.

In this paper, which is divided into three parts, I shall present, first, the results of original computations of two series of index numbers for American prices. Hitherto, the purpose of index numbers has been chiefly to measure the changing cost of living in order to compare the relative conditions of successive years for the same country.

In the second part of this paper, I have endeavored to present some comparative measurements of the changing cost of living for various countries at the same time, and, incidentally, to devise an international index number, based on some index numbers of the United States, England and France. In the third part, it is interesting to consider briefly various remedies for the instability of the price level, and to inquire whether a society has not within its control indirect methods of reducing absolutely the cost of living—methods which may prove more fruitful than some of the direct methods which have been suggested from time to time in order to secure a relative rather than an absolute reduction.

It is unnecessary to present a technical description of my two series of index numbers for American prices which have been described in the *Quarterly Journal of Economics*,<sup>2</sup> and elsewhere.<sup>3</sup> Suffice it to state that the general method of the Sauerbeck system has been adopted along with certain modifications, some of which were suggested by Forbes and others occurred as practical necessities of the computation.

<sup>2</sup> *Quarterly Journal of Economics*, August, 1910.

<sup>3</sup> Pamphlets on Index Numbers, published by the Gibson Publishing Co., 1910-11.

The two index numbers may be described as the averages of the percentages of the prices of fifty important commodities expressed in terms of the average prices of the years, 1890 to 1899, so that the average price level of the years 1890 to 1899 is the base or one hundred per cent. Two systems of weighting have been used. My first series follows Sauerbeck in the use of the simple arithmetical average. The second series was intended as an approximate continuation of the Dun index numbers which ended in 1907, and which have been published since 1910 as the Gibson index number. The same arbitrary weighting is used in the two series, although the Dun numbers were based on three hundred and fifty commodities and the Gibson on fifty leading commodities. Mitchell<sup>4</sup> has shown that my method of continuing the Dun numbers by using fifty primary commodities rather than three hundred and fifty commodities, many of which are derivative, produces an average difference on the basis of past years approximately of two per cent. The fifty commodities consist of the leading articles of commerce which are most capable of accurate grading.

In the succeeding table,<sup>5</sup> the relative weighting of the various groups, such as foods, clothing, minerals and other commodities, is presented in contrast for various index numbers, in order to suggest the cause of the slight differences which occur in the results reached by the various numbers.

The more heavily the food group is weighted, the more the total index number of all commodities tends to advance. This

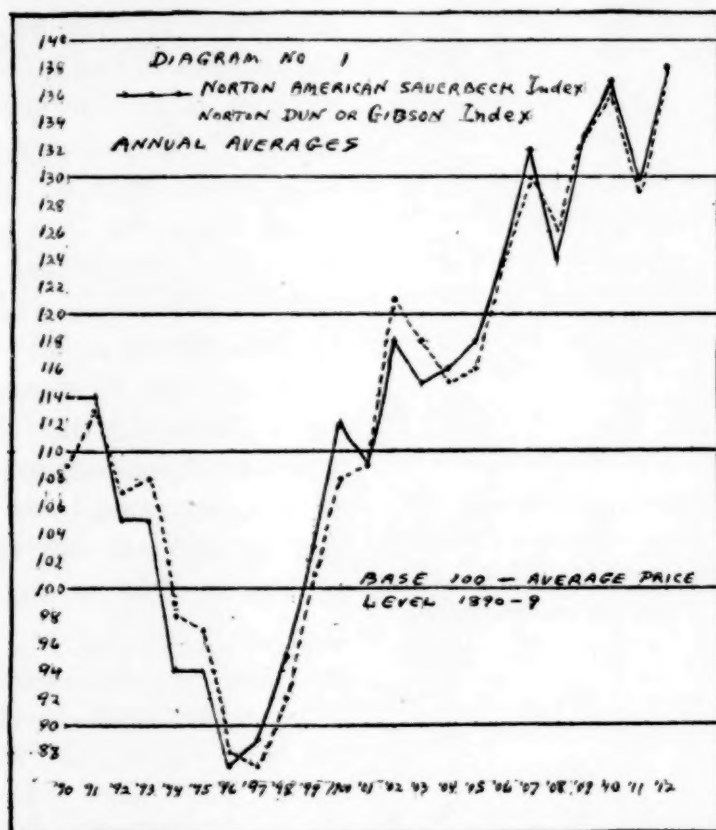
<sup>4</sup> *Quarterly Journal of Economics*, November, 1910.

<sup>5</sup> "How Index Numbers are Made," by F. C. Croxton, *Journal of Commerce*, June 2, 1910, and Norton, "Weighting of Index Numbers," June 9, 1910.

TABLE SHOWING WEIGHTING OF GROUPS IN  
VARIOUS INDEX NUMBERS

Groups of Commodities	Sauerbeck's English Index Number, Per Cent.	Norton's American Sauerbeck Index Number, Per Cent.	Norton's Gibson or Dun Index Number, Per Cent.	Bradstreet's Index Number, Per Cent.	Bureau of Labor Index Number, Per Cent.
Clothing..	42	44	50	37	26
Food .....	18	18	18	10	29
Other.....	40	38	32	53	45

number,<sup>6</sup> the second column the Dun and Gibson series, and the third column the Dun and Gibson series reduced to the same base as the American Sauerbeck which is the average price level of the years 1890 to 1899 as one hundred per cent. This table is represented graphically by diagram No. 1.



point will be discussed later in this paper. On the other hand, if a large weight is given to manufactured articles, which is the case in the United States Bureau of Labor index numbers, the tendency is to reduce the extent of advance. The group weighting influences the results more than the fluctuations of single commodities, because all commodities of the food group are in a large measure in competition through possible substitution by consumers. The following tables, which are represented by diagrams, disclose the annual averages for the period, 1890 to 1912. The first column contains the American Sauerbeck index

The annual average difference of the two index numbers is two per cent.

To summarize the general movements, a five year average table has been prepared. This table shows how little the weighting has influenced the results in the two series, because the weighting for the food group differs in the two numbers to a less extent than in the case of the other possible comparisons.

<sup>6</sup> Norton's "Lessons Suggested by the Experience of the French People and of the Bank of France," *Proceedings of the Academy of Political Science*, January, 1911.



TABLE OF ANNUAL AVERAGES OF TWO INDEX  
NUMBERS FOR AMERICAN PRICES

	American Sauerbeck Index Number	Dun or Gibson Index Number	Percentage Dun Index Number
1890	114	92	109
1891	114	96	113
1892	105	90	107
1893	105	91	108
1894	94	83	98
1895	94	82	97
1896	87	74	88
1897	89	73	87
1898	95	78	92
1899	103	85	101
1900	112	91	108
1901	109	92	109
1902	118	102	121
1903	115	100	118
1904	116	97	115
1905	118	98	116
1906	124	105	124
1907	132	110	130
1908	124	106	126
1909	133	112	133
1910	137	115	136
1911	130	109	129
1912	138	117	138

TABLE SHOWING THE FLUCTUATIONS OF THE FIVE-  
YEAR AVERAGES OF THE TWO INDEX NUMBERS  
FOR AMERICAN PRICES

	Dun-Gibson	Norton-Sauerbeck
1890-94 .....	107	106
	- 14	- 12
1895-99 .....	93	94
	+ 21	+ 20
1900-04 .....	114	114
	+ 12	+ 12
1905-09 .....	126	126
	+ 8	+ 9
1910-12 .....	134	135

It is clear that both series of index numbers agree rather closely in showing that we have been living in an era of a prolonged advance in the cost of living during the past fifteen years. In summary, using my American Sauerbeck index numbers, the price level of 1912 is some 59 per cent. above the level of 1896, and compared with 1890, the percentage of advance is 21 per cent.

Such instability in the average price level is unfortunate, and, whether we attribute

the causes solely to forces acting on commodities or to fluctuations in the gold standard or to both causes, the central fact remains that the instability of the price level has caused many hardships to our people.

Let us now construct two index numbers by splitting up the component groups into a food index number and an "other than food" index number, using the average prices of each group, respectively, as the two bases, one hundred per cent. The purpose is to discover the relative movements of the two groups, foods and other than foods, over a period of fifty years. Using the early Dun numbers, reduced to the new percentages, we may present a rough comparison, which, I think, throws light on the situation.

What has happened becomes obvious upon inspecting the following table, which presents the conditions of the price levels of the two groups for selected years, during the period commencing in 1860 and ending in 1912.

TABLE SHOWING THE FLUCTUATIONS OF THE FOOD  
INDEX IN CONTRAST WITH THE INDEX FOR  
OTHER COMMODITIES FOR SELECTED  
YEARS. 1860 TO 1912

	Index Number for Foods	Index Number for Commodities Other than Foods
1860 .....	145	155
1864 .....	293	452
1870 .....	195	200
1875 .....	167	160
1880 .....	138	155
1885 .....	117	112
1888 .....	126	112
1889 .....	124	112

The above statistics are as of January 1.

1890 .....	102	117
1891 .....	121	107
1892 .....	107	107
1893 .....	110	107
1894 .....	102	95
1895 .....	100	95
1896 .....	81	95



1897 .....	83	88
1898 .....	93	93
1899 .....	100	102
1900 .....	105	112
1901 .....	105	114
1902 .....	126	117
1903 .....	117	119
1904 .....	105	112
1905 .....	112	121
1906 .....	119	131

The above statistics are as of July 1.

1907 .....	121	140
1908 .....	129	124
1909 .....	140	126
1910 .....	140	133
1911 .....	136	124

The above statistics are annual averages.

1912 .....	148	131
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The figure for July, 1912, is given as the last comparison.

From the average of the low years, 1896-1897 down to 1912, the food group has advanced 80 per cent. and the "other than food" group 43 per cent. Thus, compared with the two low years, 1896-97, foods have advanced nearly twice as much as other commodities. Consequently, the hardships experienced by the classes of the smaller incomes have been very great throughout the world, inasmuch as in all family budgets the percentage spent for foods increases as income diminishes.

But, if we take as representative the figures of 1860 and 1880, leaving out of account the years of the Civil War and of suspension of specie payments, we have 142 for foods and 155 for other commodities. Comparing the conditions of the years 1860 and 1880 with the low years 1896-97, we might have said in 1896 and 1897 that foods had fallen 60 points and other commodities 63 points, or turning the comparison about, food prices as well as other commodities in 1860 and in 1880 were approximately 70 per cent. higher in 1860 and in 1880 than in 1896-97. In

short, food prices are now on the level of 1860 and 1880 and other than food prices are probably 15 per cent. lower.

In summary, since food prices during the past fifteen years have advanced in the United States nearly twice as much as the "other than" food commodities, it is unlikely that the tariff has played so important a part as other causes. Possibly, the tariff is indirectly responsible to some extent in over-stimulating industries of the "other than food" group, and in this way helps to contribute to a deficit proportion of agricultural population.

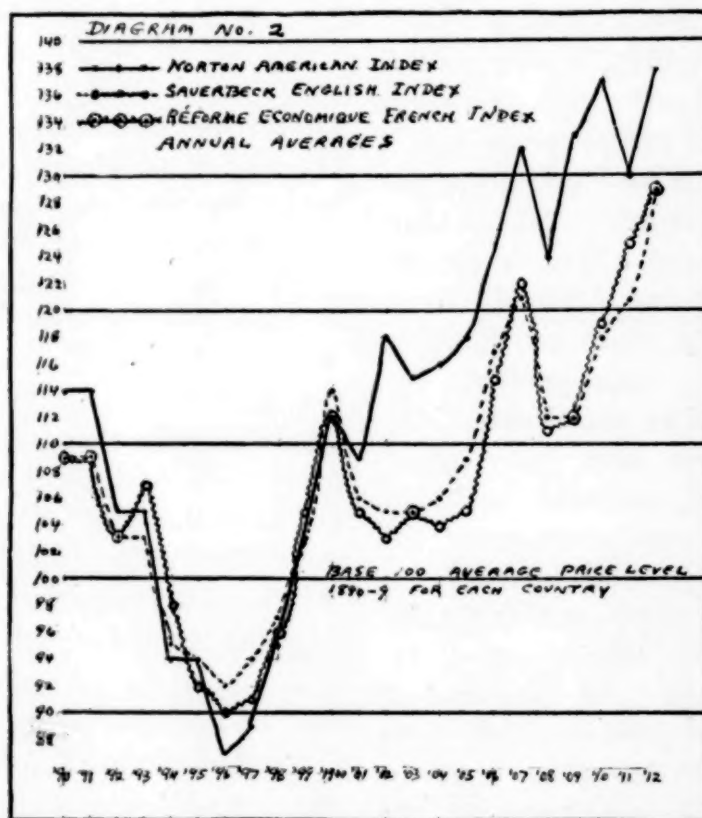
It seems more probable, however, that the great drop in prices which occurred from 1880 to 1896 represents in part the effects of the unprecedented railroad construction of those days and of the utilization of new inventions in farm machinery, two causes which were at work and must have cheapened the average cost of production of the food group. Naturally, rural population was displaced by farm machinery and we know that thousands of acres of farm lands in the east were rendered of less value by the falling prices, resulting from the application of these two great lines of inventions. As food prices fell and immigration continued on a large scale the wage rates fell, and reduced wages made the cost of production of other commodities lower and naturally the prices went down in sympathy with the lower cost of production.

Food prices are fundamental and "other than food" commodities are derivative through the wage scales which vary with the cost of food. Further, all statistics indicate a steady drift of population away from the food industries to the "other than" food industries, suggesting that the opportunity to secure steady work by labor less securely attached to land has been better in the "other than food industries."

The various movements to extend agricultural credit, to improve systems of distribution and to furnish instruction to the agricultural classes are doubtless in the right direction. But, it is difficult to see how these movements, beneficial as they may prove, can much more than keep pace with similar movements making urban work more productive, such as rapid transportation, trade schools, night schools, etc. In fact, the simple economic force to increase the relative production of foods is, after all, a continued higher level of food prices which will tend to raise farm wages and to stimulate increased production generally in all of the land pursuits.

In order to make comparisons, Sauerbeck's index number for England and the index number<sup>7</sup> for France are reduced to percentages of their own averages for the years, 1890-99, respectively. Thus, the three numbers for each year are simply percentages of the average price level of the decade, 1890-99, for each of the countries. Diagram No. 2 represents the fluctuations of the index numbers of the three countries.

This method affords a system of comparative measurements of the changing cost of living for different countries, but does not necessarily afford a basis for the measurement of the absolute cost of living in dif-



We come now to the second part of this paper, the comparative measurements of the changing cost of living, geographically considered. In the following table, illustrated by diagram, we may contrast the changing cost of living in the United States, England and France.

ferent countries. The latter is, also, an important problem which should be undertaken, the solution of which will require patient critical work in the determination of equal grades of commodities in various countries.

<sup>7</sup> Published monthly by *La Réforme Economique*.

The fourth column contains the records of my international index number which is simply the average of the three preceding numbers for each year. It is interesting to note that American prices, commencing in 1902, advanced much more rapidly than did the price levels of foreign countries, but in the years 1911 and 1912 the margin of difference was considerably reduced.

TABLE SHOWING INDEX NUMBERS OF THE UNITED STATES, ENGLAND AND FRANCE

	United States Norton Sauerbeck	England Sauerbeck	France Reforme Economi- que	Norton Inter- national
1890	114	109	109	111
1891	114	109	109	111
1892	105	103	103	104
1893	105	103	107	105
1894	94	95	98	96
1895	94	94	92	93
1896	87	92	90	90
1897	89	94	91	91
1898	95	97	96	96
1899	103	103	105	104
1900	112	114	112	113
1901	109	106	105	107
1902	118	105	103	109
1903	115	105	105	108
1904	116	106	104	109
1905	118	109	105	111
1906	124	117	115	119
1907	132	121	122	125
1908	124	112	111	116
1909	133	112	112	119
1910	137	118	119	125
1911	130	121	125	125
1912	138 <sup>s</sup>	129 <sup>s</sup>	129 <sup>s</sup>	132 <sup>s</sup>

We are led by our system of comparative measurements of the changing cost of living to the conclusion that world-wide causes are primarily responsible for the prolonged advance in the cost of living. It is probable that accurate statistics would show for India, China, the Argentine, in fact for all countries of the world which are connected by commercial relations, quite similar conditions. My international index number for 1912 shows an advance of 46 per cent. over the low year 1896, in comparison with 59 per cent. for the United

<sup>s</sup> Average based on first ten months.

States, 40 per cent. for England and 43 per cent. for France. It should be noted that the United States numbers have advanced considerably more than the index numbers of foreign countries. But we should remember that commodities "other than" food advanced 49 per cent. in the United States, which is on a parity with the advances of all commodities for England and France.

TABLE AFFORDING COMPARISONS OF 1896 AND 1912, AND 1880 AND 1912

	Advance 1896-1912, Per Cent.	Advance 1880-1912, Per Cent.
United States, foods .....	83	7
United States, other than foods	49	— 15
United States, all groups ....	59	— 6
England, all groups .....	40	— 3
France, all groups .....	43	

The extraordinary advance occurs in the food group of the United States, and it is quite possible that this represents several causes, some of which are technical, some of which are national and some are connected with the chain of sequences produced by an increasing production of gold. It is plain that international causes are at work. During sixteen years following 1880, world prices fell, and during sixteen years following 1896, world prices rose. It is interesting to note that independent computations show that after thirty-two years prices in the United States and in England have recovered very nearly the entire amount of the decline which reached the low point in 1896, and that now world prices are upon an approximate parity with those of 1880.

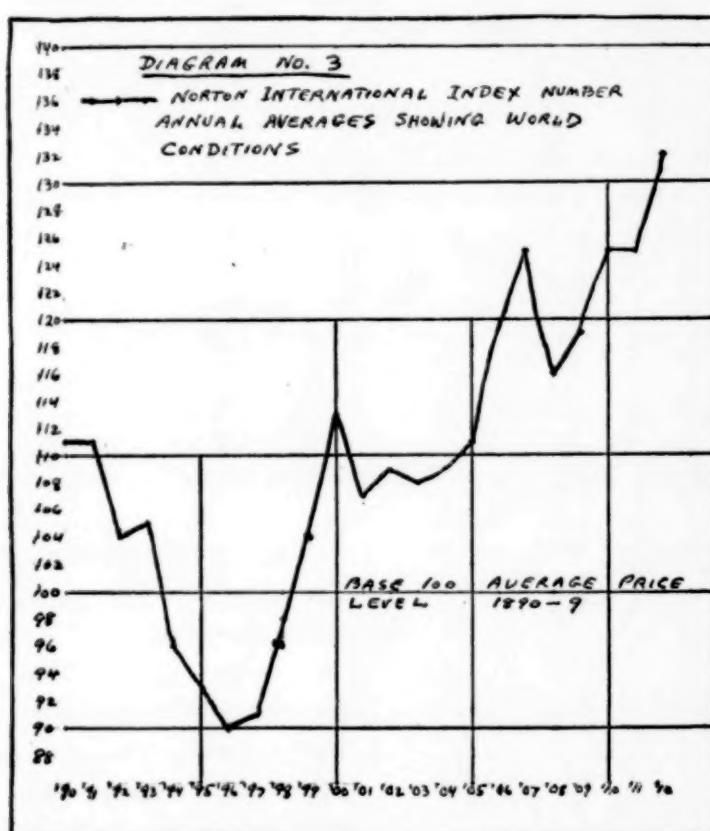
An excellent opportunity is afforded the recently appointed Industrial Commission to determine the rates of wages prevailing



in 1912 in comparison with 1880, because the cost of living conditions in the two years are very much alike and the years are far enough apart in time to furnish an excellent basis for sound conclusions regarding the relative rates of income of all classes of labor. The results would probably surprise those economists who distrust the possibilities of social progress.

finally recommended this plan to congress. Endorsements have been given by resolutions of the New York Chamber of Commerce and more recently by the International Congress of Chambers of Commerce of the world. The Sulzer bill, providing for such a commission, is now before congress.

The work of such an international com-



In 1907, the writer proposed the appointment of an international commission<sup>9</sup> to study the causes of the advancing price level, believing international causes were chiefly responsible. In 1912, as a result of the Washington meetings, when Senator Burton, vice-president of the American Association for the Advancement of Science, read a paper on the causes of the high prices and Professor Irving Fisher spoke before the American Economic Association in favor of the proposition, President Taft

<sup>9</sup> *Yale Review*, 1906, and *Moody's Magazine*, 1907.

mission on the cost of living might well include the computation of a series of identical numbers for the principal countries of the world. Such index numbers should disclose the absolute as well as the relative changing cost of living as measured by fifty to one hundred leading commodities, by providing for identical commodities, identical grades and identical weighting. Such an investigation is quite as proper for the Carnegie Institution or for the United States Bureau of Standards to undertake, inasmuch as such measurements of price levels are not only very central,

but also pressing problems of economic research.

If a complete and thorough investigation should be undertaken to show the relations of the price movements of the principal countries, it is probable that the composite result expressed in the form of an international index number would not differ greatly from my international index number in statistical significance. The international index number is represented by diagram No. 3.

What would this result mean? I think that we should have in a well-defined form an approximation to those two concepts concerning which Jevons wrote, namely, first, an international multiple standard of value, and, second, a method of achieving the use of international money by making the present currency of all nations token money under the new standard of value.

Since we hold that the evidence shows

that international causes are largely responsible for the advance in prices, we may omit consideration of many of the remedies which have been proposed from time to time which, if applied, would be essentially local in their operation.

What are the international causes which could have produced this common rise of more than forty per cent. since 1896 in three countries, and what could have been the common international causes for the fall in prices of the period, 1860-1896? The writer believes that the international causes are three in number. First, cheaper transportation was responsible for a part of the decline, 1880-1896, and the cessation of railroad building on a large scale coupled with increasing consumption resulted in the recovery following 1896 in some part. Second, extensive use of farm machinery lowered the cost of production throughout the world and the use of labor-saving machinery on farms resulted in a relative displacement of farm labor, causing the relative exodus from the agricultural occupations. This caused a part of the decline in food prices down to 1896. This table of averages of food prices in comparison with the prices of other commodities indicates what have been the changes in the two groups by five-year periods. Diagram No. 4 discloses the trend of these averages.

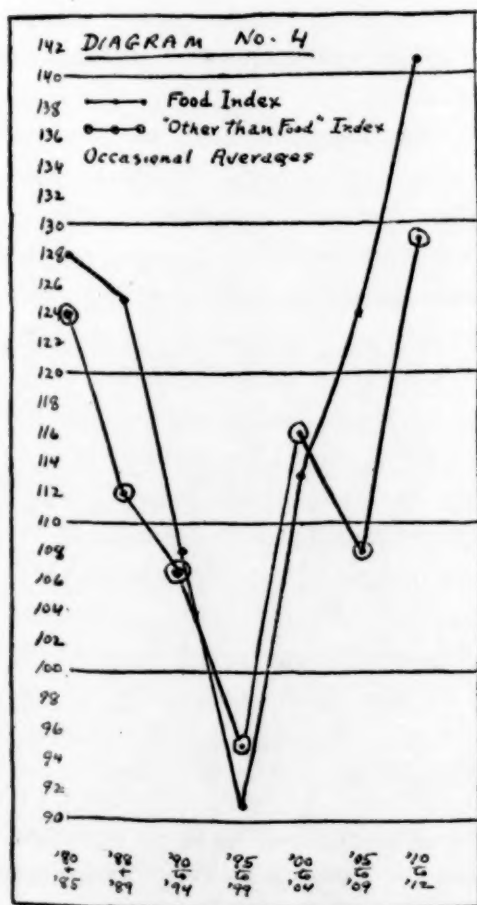


TABLE SHOWING FIVE-YEAR AVERAGES OF FOOD INDEX AND "OTHER THAN" FOOD INDEX

1880 and 1885 ...	128	124
	— 3	— 12
1888 and 1889 ...	125	112
	— 17	— 5
1890-94 .....	108	107
	— 17	— 12
1895-99 .....	91	95
	22	21
1900-04 .....	113	116
	11	— 8
1905-09 .....	124	108
	17	21
1910-12 .....	141	129

Naturally, lower prices for foods resulting from cheaper transportation and the displacement of farm labor by agricultural machinery resulted in a world-wide relative urban movement. Undoubtedly, several years of continued high food prices will prove the most efficient cause to encourage an increased production of foods. All legislation making agricultural credit available and affording opportunities to acquire land on favorable mortgage conditions will contribute to this end.

The third international cause is undoubtedly the increased production of gold<sup>10</sup> commencing in the late nineties. Just as excess of paper money in the Civil War period inflated prices, so the excessive gold supplies have inflated international prices, and all credit devices economizing the use of gold have helped to magnify the tendency towards inflation. Possibly, the greater advance in food prices of the United States is due to the greater influences of the first two international causes in the United States, and the so-called gold influence may be responsible for the larger part of the common advance. However, the relative importance of the three international causes may not be accurately estimated.

But the facts remain that the instability of the international price level is a disturbing element and the difficulty is that we measure all commodities in terms of one commodity rather than in the terms of fifty or more important commodities. In 1910, the writer recommended the establishment of an optional multiple standard,<sup>11</sup> possibly by the Bureau of Standards. In referring to this proposal, the Massachusetts Commission on the Cost of Living says:

<sup>10</sup> Norton's "Gold Flood," *Cosmopolitan Magazine*, June, 1910.

<sup>11</sup> Norton's "The Remedy for the High Prices," *Independent*, February 10, 1910.

It is hard to see how any harm could come from giving official aid to the maintenance of such a standard for the use of any borrowers and lenders who chose to adopt it. In the event of a long continuance of the upward movement of prices, its use might prevent serious injustice and great hardship. We recommend that our senators and representatives consider the expediency of advocating its establishment.

The two classes which suffer most by the instability of the price level are wage earners and investors.<sup>12</sup> If wages were payable in the multiple standard, wages would fluctuate with cost of living and strikes would be diminished to a very great extent. If long time obligations were expressed in the multiple standard, creditors and debtors would exchange equal amounts of purchasing power. Now, all of these classes—the manufacturers, the labor unions, the bankers and the investors are intelligent. Why not leave the determination of the standard to agreement, and as a first step simply create an optional multiple standard which could be used when specified in wage contracts and in long time obligations.

The reasonable basis of an optional multiple standard would win its way and the economic benefits experienced would counsel its extension. By proper organization of clearing houses under a national clearing house,<sup>13</sup> by regulation of storage-warehouse warrants and the clearances of all classes of stock and produce exchanges, all transactions could be made either by the present currency made token money under a multiple standard, or by clearances direct in the optional multiple standard, since the holder of one unit of the optional multiple standard could convert into the value of any other commodity, if all prices

<sup>12</sup> Norton's "Stocks as an Investment when Prices are Rising," *Securities Review*, September, 1912.

<sup>13</sup> Norton's "Central Bank as a Federal Clearing House," *Moody's Magazine*, September, 1910.



were expressed in terms of the optional multiple standard, which involves simply a change of or a new definition of the dollar. This would be the final result, long anticipated by the economists. I quote from Patron's monograph on the Bank of France, prepared for the Monetary Commission:

The interesting evolution of exchange which we are witnessing and which is familiar to everybody seems to be leading us, after the well-defined periods of barter and money, to a system of mere clearing of balances. All exchange operations would then be settled by simple book transfers. Coin reduced to money of account, would cease to play any real part. Economists are ever thinking of a return to barter, which would complete the cycle, bringing us back to the original state after thousands of years and combinations of all kinds. Such would be the course of this evolution.

But, as changes in monetary standards come very slowly, because men are unwilling to change the old landmarks without most careful investigations, we do not anticipate that the vision originally seen by Jevons will come to pass at once, even though the economists are again discussing this question after the lapse of many years.

If prices continue to mount actively, the agitation for such a change will occur with increasing force. But, we must remember, so far as the gold factor is concerned, that there are eastern nations with vast populations, capable of absorbing large quantities of gold under the stimulus of the western learning which is working as a yeast of progress among them. Further, we can steady prices and produce a declining tendency by requiring a larger proportion of gold in the reserves of the banks. This would at the same time strengthen the whole credit system. If we should go farther and require minimum flexible<sup>14</sup> reserves, higher in dull seasons and lower in

<sup>14</sup> Norton's "Statistical Studies in New York Money Market," 1901.

active seasons, and incidentally higher on the average, as just suggested, a considerable fluctuating tendency would be eliminated.

After all, the Fabian policy lies before us, and looking ahead, it is probable that the agitation over this subject will be largely influenced by the course of commodity prices during the coming two years. This diagram discloses the quarterly fluctuations of my new international index number for the past five years. It is probable that we have passed the high point for two years or more, and that lower prices are now in order.

TABLE OF MONTHLY INDEX NUMBERS—NORTON  
INTERNATIONAL SERIES

	1907	1908	1909	1910	1911	1912
Jan. to March.....	125	117	116	125	124	129
April to June.....	127	116	118	125	124	135
July to Sept.....	126	115	119	125	125	132
Oct. to Dec.....	122	115	121	123	126	

If this position shall turn out to be correct, we shall be in a better position two years from the present time to estimate whether the growth of population, the absorption of gold by eastern nations and the higher level of prices shall have overtaken the rate of increase of gold production sufficiently to produce an era of falling prices. When this occurs, as it will occur, sooner or later, we shall have the reverse agitation of the agricultural classes against falling prices such as our country witnessed in the Populistic agitations of the early nineties.

The money question, which has been a political issue, constantly changing in form and exceedingly disturbing to business, will continue to be with us so long as the instability of the price levels continues.

One result of the prolonged advance in the cost of living has been to emphasize the necessity of "economy," not only personal,

but also "political," quite in the original sense of political economy. The very name of the movement which in a way is a constructive reaction from the economic stimulus of a lessened purchasing power is significant. I refer, of course, to the conservation movement. The word conservation, although vague, stands for the diminishing of wastes. In the conservation movement, we have a return to the original purposes of "political economy." The items which make up the cost of living as represented by an average family budget suggest plainly the directions in which the prevention of wastes may prove most fruitful. In the attempt to reduce the absolute cost of living, society wages an eternal warfare against the destructive wastes of nations,<sup>15</sup> which are preventable war, preventable ignorance, preventable sickness, whether physical, intellectual or moral, preventable death, preventable accidents to life and property, and preventable lack of opportunity which may delay or prevent the productivity of exceptional minds like those of Edison and Burbank, which exist in all degrees in certain proportions in the population. The latter waste is the greatest waste which society still permits. The public school system is an institution created to furnish equal opportunity for education, but it is probable that a system of vocational guidance for exceptional children, *i. e.*, above the average, would prove an extremely profitable policy for a nation to undertake on a large scale.

If we admit that in a population some are exceptional beyond others in intelligence, in foresight and in inventive capacity—and we know this to be true by the prevalence of idiots, insane persons, criminals and paupers, classes below the aver-

<sup>15</sup> Norton's "Economic Advisability of a National Department of Health," *Journal of American Medical Association*, August, 1906.

age—it follows that the larger the population of the same strain, the greater will be the number of exceptional minds above the average. It is self-evident that the national dividend of a better civilization is created by the exceptional minds of a nation for the higher utility of all. We reduce absolutely, not relatively, the cost of living when we discover a cheaper method of controlling the matter and the forces of the world. Thus, a natural tendency to progress<sup>16</sup> is inherent in an increasing population, unless checked by the destructive wastes of nations. Nor can we overestimate the importance of ethical and hygienic standards in the study of political economy. Our measurements and standards of utility must be based on ethical and hygienic values rather than on conceptions of ophelimity or desirability.

By ethical standards, we mean to include among others the more enlightened conceptions of jurisprudence, and by hygienic standards the well-balanced judgments of enlightened medical and sanitary experts. But the guidance of present statistics of the cost of living supplemented by vital statistics is essential to a balanced judgment and the lack of accurate statistics on social and economic subjects is well known. Without measurements, our conclusions must be vague.

J. PEASE NORTON

NEW HAVEN, CONN.

#### PLANS FOR A GREATER UNIVERSITY OF MONTANA

BETWEEN forty and fifty prominent citizens of all parts of the state of Montana met at Helena, December 23, and organized the Association for the Creation of a Greater University of Montana. This is to be brought about by the consolidation of the present iso-

<sup>16</sup> Norton's "Cause of Social Progress and the Rate of Interest," *Popular Science Monthly*, September, 1910.



lated institutions of higher learning, the university, the agricultural college, the normal school and the school of mines at some city which is desirably situated. The plan is supported by the proposed conversion of the plans and equipment that would otherwise be abandoned into a system of polytechnic high schools.

A comprehensive outline of the change sought to be effected is given in the constitution and by-laws of the association, organized at that time before the meeting of the board. This follows:

The name of the organization shall be "The Association for the Creation of a Greater University of Montana."

The purpose of this association shall be:

1. To consolidate the four higher educational institutions of the state in order to prevent the educational and financial waste brought about by the maintenance of separate and isolated institutions.

2. To establish, instead of the four institutions, a greater University of Montana to be situated in or near some city suitable by reason of its railroad connections, climate and water and health conditions to be a great seat of learning.

3. To work for the creation of a splendid system of polytechnic high schools which are at the present time so much needed; this to be brought about by means of (a) the utilization of all the present plants that would otherwise be abandoned, (b) the utilization of the military post at Fort Assiniboine if the government turns it over to the state; (c) the establishment of similar schools in other sections of the state as they may from time to time be needed.

4. To impress on the attention of philanthropic persons, especially men of great means, the desirability of aiding the development of the University of Montana, through the provision of buildings and endowments.

5. To arouse public sentiment in favor of education and to arouse the enthusiasm of the people to the unsurpassed educational possibilities of the great commonwealth of Montana.

The state board of education, after giving a hearing to the representatives of this resolution, unanimously adopted resolutions recommending that the legislature consolidate the institutions and pledging the members to do

all within their power to encompass the result sought.

#### THOMAS HARRISON MONTGOMERY

At the recent meeting of the American Society of Zoologists in Cleveland, Ohio, the following resolution was submitted by Dr. A. G. Mayer on behalf of the executive committee. The resolution was then approved by a rising vote of the society.

Never has a deeper sense of irreconcilable sorrow fallen upon us of this society than that following the announcement of the death of Thomas Harrison Montgomery on the nineteenth day of March, 1912, at the early age of thirty-nine years.

Other friends, leaders in science, have gone before, but they were full of years and the labor of their lives was as a story well nigh told; but with Montgomery the tasks that lay before him were those of the greater years of life, that period of intellectual fruition for the harvest of which his years of toil and training had been a preparation.

While thus but upon the threshold of his middle years, science lost him; but irreparable as these things be, it is as our friend we mourn him most.

No ordinary motives actuated him in his scientific work, for personal ambition never clouded his simple love for truth wherever truth might lead him.

It is to unselfish men such as he that great opportunities are entrusted, and the equipment and organization of the new Zoological Laboratory of the University of Pennsylvania was a task he had all but completed, and this will serve as a fitting monument to his ability as an executive.

On the scientific side, he was the author of nearly one hundred publications, and it would be impossible to write a text-book upon the rôle of the chromosomes in the determination of sex without referring to his crucial labors in this field.

It is seldom that we see a man even far advanced in years attain to the achievement he accomplished. Yet as our friend and our companion we mourn him most, for science will and must be advanced; but to us there ever will be but one Montgomery, the generous friend, sympathetic and simple, Montgomery the gentleman who loved us and whom we loved.

W. C. CURTIS,  
*Secretary*



## SCIENTIFIC NOTES AND NEWS

THE Elisha Kent Kane gold medal of the Geographical Society of Philadelphia was presented to Professor William Morris Davis, of Harvard University, on January 28. On that evening Professor Davis made an address on "Human Response to Geographic Environment," inaugurating the Heilprin memorial lectures. Professor Davis will receive the Culver medal of the Geographic Society of Chicago, at the annual dinner on February 19.

PROFESSOR GEORGE HERBERT PALMER, Alvord professor of natural religion, moral philosophy and civil polity, and Professor Francis Peabody, Plummer professor of Christian morals, have given their final lectures at Harvard University. Professor Palmer has served the university for forty-three years and Professor Peabody for thirty-eight years.

PROFESSOR GEORGE F. SWAIN, of Harvard University, has been elected president of the American Society of Civil Engineers.

DR. CHARLES L. DANA has been elected president of the New York Psychiatric Society, and Dr. S. Ely Jelliffe, president of the New York Neurological Society.

MAJOR E. H. HILLS, F.R.S., has been appointed honorary director of the Durham University Observatory.

SIR SYDNEY OLIVIER, governor of Jamaica, has been appointed to be permanent secretary of the British Board of Agriculture and Fisheries.

DAVID R. KELLOGG, Ph.D. (Ohio State, '12), has accepted a position as research chemist in the Bureau of Mines, with headquarters at San Francisco.

DR. R. C. BENEDICT has been appointed editor of the *American Fern Journal* to succeed Dr. Philip Dowell, who declined to be considered for reappointment.

DR. A. HRDLÍČKA, of the United States National Museum, has sailed for Peru and Bolivia, with the object of extending his former work in those countries, and securing further anthropological collections. He expects to return in April.

DR. ROLLIN T. CHAMBERLIN, of the University of Chicago, lectured on a visit to Brazil, before the Geographical Society of Chicago, on January 24.

DR. J. ARTHUR HARRIS, of the Carnegie Institution, spoke before the Society of Sigma Xi of Washington University on January 23, his subject being "The Francis Galton Laboratory for National Eugenics and its Work."

BEFORE the Society of the Sigma Xi of Columbia University, Professor Henry C. Sherman lectured on January 16, on "Progress and Problems in Food Chemistry."

DR. VICTOR C. VAUGHAN, dean of the School of Medicine of the University of Michigan, addressed the Science Club of the University of Wisconsin, January 16, on "Eugenics, or Race Betterment."

THE Semon lectures on laryngology were delivered at University College on January 22 and 24, by Dr. Peter McBride, the subject being "Sir Felix Semon: His Work and its Influence on Laryngology."

MR. FRANCIS BLAKE, who did important work under the U. S. Coast Survey from 1866 to 1878, and subsequently obtained distinction by the invention of the telephone transmitter and other electrical apparatus, died at his home in Weston, Mass., on January 19, aged sixty-three years.

PROFESSOR JONATHAN HYATT, known for his contributions on insect anatomy, former president of the American Microscopical Society, died at his home in New Rochelle, on December 20, aged eighty-six years.

MRS. WILLIAM BASHFORD HUFF, formerly demonstrator in physics in Bryn Mawr College, the author of contributions to physics and mathematics, died on January 19, aged twenty-nine years. In 1898 she married Dr. William Bashford Huff, professor of physics at Bryn Mawr College.

DR. WILLIAM HOWSHIP DICKINSON, a distinguished English physician and pathologist, died on January 9, aged eighty years.

MR. B. LEIGH SMITH, known for his work in Arctic exploration, died on January 4, at the age of eighty-five years.

THE U. S. Civil Service Commission announces an open competitive examination on February 26, for forest pathologist, to fill a vacancy, at a salary ranging from \$1,980 to \$2,400 a year, in the Bureau of Plant Industry, Department of Agriculture, for service either in Washington, D. C., or in the field. On February 26 there will be examinations for scientific assistant of soil surveying in the Bureau of Soils, at salaries ranging from \$960 to \$1,200 a year, and for assistant irrigation engineer in the office of Experiment Stations at salaries ranging from \$1,200 to \$1,600.

ARTICLES of incorporation for the "Rockefeller Foundation" to administer a fund of \$100,000,000 to be given by Mr. John D. Rockefeller, were passed on January 21 by the House of Representatives by a vote of 152 to 65. The measure now goes to the Senate. The bill, introduced by Representative Peters, of Massachusetts, names as the incorporators to administer the fund, John D. Rockefeller, John D. Rockefeller, Jr., Frederick T. Gates, Starr J. Murphy, Harry Pratt Judson, Simon Flexner, Edwin A. Alderman, Wickliffe Rose and Charles O. Heydt, and such persons "as they may associate with themselves." The object of the foundation is "to promote the well-being and to advance the civilization of the peoples of the United States and its territories and of foreign lands in the dissemination of knowledge, in the prevention and relief of suffering and in the promotion of eleemosynary and philanthropic means of any and all of the elements of human progress."

At the instance of the Southern Commercial Congress the governors of some of the states are appointing two delegates each to go to Europe about April 26 and to remain there three months studying the system of rural credits and land banks there existing, with a view to adapting the system to this country.

ARRANGEMENTS have been completed by which the American agency for the following journals of the Cambridge University Press will be in the hands of the University of Chicago Press, beginning January 1, 1913: *Biometrika*, *Parasitology*, *Journal of Genetics*, the *Journal of Hygiene*, the *Modern Lan-*

*guage Review*, the *British Journal of Psychology* and the *Journal of Agricultural Science*.

THE will of Alfred Samson, who died recently at Brussels, provides for an endowment of \$500,000 for the Prussian Academy of Sciences and \$100,000 for the Bavarian Academy of Sciences, at Berlin and Munich. The endowments are stated to be for investigations which afford a prospect of raising the morality and well being of the individual and of social life, including the history and prehistory of ethics, and anthropologic, ethnologic, geographic, geologic and meteorologic influences as they have affected the mode of life, character and morals of man.

THE Woman's Medical Association of New York City offers the Mary Putnam Jacobi Fellowship of \$800 available for postgraduate study. It is open to any woman graduate of medicine. The amount of the endowment to date will permit of a biennial award, and upon the completion of the fund, this will be made annually. The fellowship will not be awarded by competitive examination, but upon proof of ability and promise of success in the chosen line of work. Applications for the year 1913-1914 must be in the hands of the committee on award by April 1, 1913.

ON February 6, 7 and 8, 1913, in the electrical laboratory of the University of Illinois, the students of the department of electrical engineering will give their triennial electrical show. Although under student management, it will be by no means wholly a student show, as many manufacturing and sales companies in the electrical trade will offer exhibits. Among the exhibits will be isolated lighting plants, heating and cooking accessories, telephone, telegraph, and wireless apparatus, lifting magnets, motor controllers, high frequency machinery and a complete electrically operated café. Student demonstrators or manufacturers' representatives will be in charge of each exhibit. One special feature planned in connection with the show is an exhibit of all types and methods of electrical lighting. This will be in charge of students of electrical illumination who will discuss with interested



visitors the best and cheapest ways of lighting their buildings. Under the general direction of Dr. E. J. Berg, head of the department of electrical engineering, a business organization composed of graduate and undergraduate students is carrying on the entire work incident to the show.

THE Wagner Free Institute of Science of Philadelphia announces a course of four free public lectures under its Westbrook Free Lectureship Foundation on Conservation of Natural Resources, as follows:

January 18—Gifford Pinchot, president, National Conservation Association, "A Glance over the Field."

January 25—Marshall O. Leighton, chief hydrographer, U. S. Geological Survey, "Water as a Resource."

February 1—Overton W. Price, vice-president, National Conservation Association, "What shall we do with our Forests?"

February 8—Joseph A. Holmes, director, Bureau of Mines, Department of the Interior, "Saving Life and Resources in the Mining Industry."

THE Ecole D'Anthropologie de Paris announces the following courses for the year 1912-13:

Anatomic anthropology: Anatomic characters of fossil man. Professor R. Anthony.

Prehistoric anthropology: Art and industry of the Magdalenians and the neolithic populations. Professor L. Capitan.

Zoologic anthropology: Appearance of man in Europe. Hypotheses as to anthropologic centers. Professor P. G. Mahoudeau.

Ethnology: Study of Mendelian heredity—facts, laws, anthropologic applications. Professor G. Hervé.

Physiologic anthropology: Intelligence in the human species, according to race, sex, age, social categories and the individual. Professor L. Manouvrier.

Comparative ethnography: Origin and evolution of clothing and ornament. Professor A. de Mortillet.

Sociology: The social maladies. Professor G. Papillault.

Anthropologic geography: Geographic relations in prehistoric and historic times. Professor F. Schrader.

Ethnography: The French colonies, Morocco, Central Africa. Professor S. Zaborowski.

Linguistics: History of linguistics, the higher languages. Assistant Professor J. Vinson.

Series of special lectures by MM. Dubreuil-Chambardel, Franchet, Kollmann and Paul-Boncour.

THE Eugenics Education Society, as we learn from *Nature*, has arranged for three courses of lectures upon the groundwork of eugenics, to be given at the Imperial College of Science, South Kensington, from January to December, 1913. In the spring term (January to March) there will be a course of twelve lectures on elementary biology, with special reference to the reproductive system, by Mr. Clifford Dobell; in the summer term (April to July), a course of twelve lectures on heredity, including evolution, genetics, and heredity in man, by Professor R. C. Punnett, F.R.S.; and in the autumn term (October to December), a course of twelve lectures on statistical methods applied to some problems in eugenics, by Mr. G. Udny Yule. In connection with the Francis Galton Laboratory for National Eugenics, a course of six lectures will be delivered at University College, London, by Professor Karl Pearson, F.R.S. (Galton professor of eugenics), Miss Ethel M. Elderton, Dr. David Heron and Mr. W. Palin Elderton. These lectures will be given on Tuesday evenings at 8 p.m., beginning February 11, 1913, and will deal with the following subjects: heredity, environment and parental habits in their relation to infant welfare; heredity of piebaldism and of albinism in man; the relation of fertility in man to social value in the parent; some points with regard to our present knowledge of heredity in cases of feeble-mindedness; the mortality of the phthisical under sanatorium and tuberculin treatments; and recent studies of heredity in dogs, and their bearing on heredity in man.

THE Berlin correspondent of the *Journal* of the American Medical Association writes that the regular general meeting of the "Leipziger Verband zur Wahrung der wirtschaftlichen Interessen der deutschen Aerzte," was held at



Leipzig on November 25. It now includes over 75 per cent. of the German medical profession, the membership being about 25,000 on October 1, 1912. The work of the association requires the services of 1,280 confidential agents and superintendents who serve without pay. During the past business year the department for exchanges of practise placed 3,600 physicians in suitable positions. The widows' fund, a fund made up of voluntary contributions, distributed to the widows of physicians \$9,500. In preparation for the struggle which is expected to occur against the Krankenkassen in consequence of the new insurance law, a fund has been provided by contributions of at least 100 Marks, loaned without interest, which now amounts to more than \$250,000. The loan and death bureau, founded by the association in 1910, now includes 14,000 members. This serves the double purpose of making loans to its members on sufficient security and of providing a death benefit, which varies according to the contributions from \$50 to \$500. The bureau has hitherto loaned about \$165,000.

#### UNIVERSITY AND EDUCATIONAL NEWS

By the will of the late Mrs. Lucy Wharton Drexel \$70,000 is bequeathed to the museum of the University of Pennsylvania, and \$20,000 to the University Hospital.

THROUGH Dr. Andrew D. White, Mr. Andrew Carnegie has given to Cornell University \$25,000, which will probably be used as a student loan fund.

To parallel the work of the Deutsches Haus of Columbia University an anonymous donor has presented to the trustees the house at 411 West 117th Street as La Maison Française. The building, of which the cost is estimated at \$30,000, will be used as a center for the study of French literature and civilization. Columbia University has also received a gift of \$8,000 from Mr. Edward D. Adams, of New York, for the equipment of a precision laboratory for physical research, to be known as the Ernest Kempton Adams ('97S) Precision Laboratory.

By the will of Levi N. Stewart, of Minneapolis, Dartmouth College receives \$75,000 and Bowdoin College and Bates College \$50,000 each. All the bequests are unconditional. Mr. Stewart was a former inhabitant of Maine and a graduate of Dartmouth College.

TUFTS COLLEGE is given the residue of the estate of Miss Hannah S. Moulton, of Kensington, N. H., estimated at about \$25,000, for the founding of a scholarship.

THE recommendations of President Schurman, of Cornell University, in his latest annual report as to faculty participation in the university government were considered by the board of trustees at their recent meeting. The board recognized the desirability of closer relations and greater cooperation between the faculty and the board of trustees in matters pertaining to the administration of the university's affairs and referred the matter to a committee of five, to be appointed to consider and report recommendations to the board at a later meeting, final action to be deferred until after President Schurman's return.

THE regents of the University of Minnesota have voted to refer to the university senate for consideration the plan of granting six months absence on full pay in lieu of sabbatical leave for a year on half pay. It was also voted to refer to the same body the question of members of the staff accepting outside employment without the approval of the dean and the president.

PROFESSOR LUDWIG SINZHEIMER, of the University of Munich, will join the faculty of the University of Wisconsin for the second semester, taking the place of Professor Richard T. Ely, who has been appointed lecturer at the University of London during the remainder of the year.

MR. M. J. PRUCHA has been promoted from an instructorship to an assistant professorship of plant physiology in the Cornell College of Agriculture.

JOHN W. GILMORE, president of the College of Hawaii, has been appointed head of the department of agronomy of the college of agriculture of the University of California and

will take up his work at Berkeley next September.

DR. RICHARD P. STRONG, director of the Government Biological Laboratory at Manila, and professor of tropical medicine in the Philippine Medical School, has been appointed head of a newly established department of tropical medicine in the Harvard Medical School.

#### DISCUSSION AND CORRESPONDENCE

##### ON COMPARING AMMONIFYING COEFFICIENTS OF DIFFERENT SOILS

IN the issue of *SCIENCE* for November 29, 1912, there appears on page 761 a special article under the above caption by Professor Chas. B. Lipman, of the University of California. The brief is devoted almost entirely to a friendly criticism of certain conclusions drawn by the writer regarding a comparison of the ammonifying efficiency of certain Colorado soils with that of soils from other stated localities. Such criticisms, when presented in the proper spirit, and there is no reason to feel that this has not been the case here, are always welcome and are often helpful.

Now, the writer admits quite freely that the fundamental facts brought out by Professor Lipman are very largely true. However, he is not willing to concede so readily that the criticisms based upon these facts as applied to the case at hand are altogether warranted.

Among Professor Lipman's comments is to be found the following:

Despite the fact that Professor Sackett makes some qualifying statements in discussing the comparisons, he does not seem to attach importance enough to some factors of which he appears to be fully cognizant and gives no consideration to other very important factors.

In support of this statement, the critic offers the following, all of which tends to leave the impression that the writer has not taken these matters into consideration and given them due weight, in spite of the fact that statements to the contrary appear in the original publication<sup>1</sup> referred to:

<sup>1</sup>Bulletin 184, Colorado Experiment Station, June, 1912, Part I., "The Ammonifying Efficiency of Certain Colorado Soils."

The writer (Lipman) of this note fails to appreciate the value of a comparison of the ammonifying powers of various soils as obtained by different investigators whose methods vary as much as ours do to-day.

The writer in selecting the results of the work of others for comparison was particular to choose only such as were obtained in laboratories where practically the same methods have been employed, and wherever there has been any departure from the procedure of the majority, such departure has been indicated.

On page 21 of the bulletin cited occurs this statement:

The methods employed by the different experimenters have been practically the same, so the results should be comparable.

Again, Professor Lipman points out the importance of all investigators employing the same brand, in fact the same lot, of dried blood in comparative work, intimating that the writer has ignored this point. This would be an ideal condition, most certainly, the desirability of which no one questions, but how impractical! If investigators would submit the analysis of such materials as the above along with their reports, this would assist greatly in comparative studies. The writer is fully aware that dried blood may vary all the way from 6 to 13 per cent. total nitrogen, and had he not had clearly in mind the possible influence of its composition on ammonification, why should he have called the reader's attention to this statement on page 23 of Bulletin 184?

With the exception of the New Jersey figures, the percentages given in Table No. 6 are based upon blood meal containing 13.05 per cent. of total nitrogen, and cottonseed meal with 7.84 per cent. total nitrogen. In the New Jersey work, Lipman (J. G.) states that the blood meal and cottonseed meal contained, respectively, 13.18 per cent. and 6.405 per cent. total nitrogen.

Unfortunately, the composition of the blood meal employed by the different investigators cited in the comparative studies, with one exception, was not given, and consequently the writer, in order to get some basis for comparison, was compelled to compute the results



given on the basis of blood meal containing 13.05 per cent. total nitrogen, such as was employed by the Colorado Station. To the end of making available more complete data for comparative studies, the writer would take this occasion to urge those who are engaged in research work to be less reluctant about giving the details of their investigations, for it is obvious that comparative work is impossible and worthless except it be carried out with a strict observance of points of technique.

Professor Lipman refers to the importance of having a large number of soils in any comparative study:

It must also be added here that the comparison of only a few soils can not be invested with much importance, even if the soils are described by similar names.

In this matter, his point is well taken, but when the data do not exist, we must be satisfied with the information at our disposal. Moreover, it seems to the writer that a comparison of the ammonifying efficiency of twenty-seven niter soils with that of ten soils selected at random in Colorado and elsewhere should have more weight than the critic would concede.

Again, Professor Lipman writes:

It is, of course, obvious that sandy loams may embrace soils of very widely differing natures and that no just comparison can be made between a sandy loam, so called in one district, with a sandy loam so called in another district.

If this comment is intended as a criticism of Bulletin 184, it is absolutely without foundation, for no place in this publication can there be found any statement which suggests, implies or asserts a comparison of soils on a physical basis.

The one very important factor which the writer is said to have given no consideration, and upon which Professor Lipman has dwelt at some length, is what appears to be a radical departure from the normal in the method of preparing the soil cultures for studying ammonification. Professor Lipman states that "Professor Sackett sterilizes his soils with mercuric chloride and then rinses them with sterile distilled water prior to inoculation with

a soil infusion." Then follows a critical discussion of this method.

The writer begs to state in defense of this assertion that *no such procedure has ever been practised* in his laboratory and probably never will. This seemingly direct contradiction resolves itself into a rather amusing circumstance when it is learned that Professor Lipman has gained this erroneous impression, upon which he has grounded his chief criticism, from his failure to observe certain punctuation marks in the crucial sentence. On page 4 of Bulletin 184, this sentence occurs:

As soon as the soils were air dry, which seldom requires more than twenty-four hours in our atmosphere, each was ground in a glass mortar, sterilized with mercuric chloride and subsequently rinsed with boiled, distilled water, and passed through a thirty-mesh wire sieve.

From this, it is perfectly clear to the writer that it is the glass mortar which was sterilized with mercuric chloride and subsequently rinsed with boiled, distilled water. However, Professor Lipman makes it the soil which received this treatment, and thereby hangs the tale.

As confirming the Colorado investigations, the writer is pleased to learn that on several occasions Professor Lipman has noted a high ammonifying efficiency in soils of California, which contain abnormal amounts of nitrate, as well as in certain soils obtained from the vicinity of Grand Junction, Colorado.

WALTER G. SACKETT

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#### THE TERMS SEGMENT AND SEGMENTATION IN GEOLOGY

THE terms segment and segmentation which are so conveniently and widely used in the biologic sciences have not found their way into geologic literature to a very notable extent, although they seem to be well suited to geologic science. In searching for a general term which could be applied to a minor part of the earth and having the dimensions of a solid, the word segment appeared to me as the most convenient, and on reflection I recalled



that it has already been made use of in Chamberlin and Salisbury's text-book of geology, in discussing continental and oceanic segments. If it is applicable to major elements why not to minor ones as well? The parts cut off by a fault or included between faults might be called fault segments and the terms upthrow segment, downthrow segment, overthrust segment and underthrust segment would be convenient and would obviate such expressions as "the area adjacent to the fault on the upthrow side" and others which are equally unsatisfactory. Other usages of the term would follow naturally. The Colorado plateau may be cited, as an example of segmentation by faulting.

After writing the above I read the "Report on the Investigation of the Geologic Structure of the Alps," by Willis<sup>1</sup> and found the following usages of the term segment:

Each of these minor scarps is the western face of a segment of the range. . . .

It is an example of major and minor thrusting with two somewhat divergent directions of displacement and with diversities of folding in the several segments.

These are the only quotations which I can cite, but there are no doubt others which may occur to the reader. The fact that geologic text-books and glossaries do not include or define the term segment is no reason against its being used, since they follow usage rather than establish it.

GEO. I. ADAMS

IS THE "ACADEMIC COSTUME" WORTH WHILE?

TO THE EDITOR OF SCIENCE: Early in October last I accompanied my wife to the celebration of the seventy-fifth anniversary of Mt. Holyoke College, where she graduated in 1873. I was deeply and favorably impressed with the comprehensiveness and significance of the program and with the executive ability manifested by those—chiefly women—charged with its fulfilment.

Of the several functions, however, I wit-

<sup>1</sup> Smithsonian Miscellaneous Collections, Vol. 56, No. 31, 1912.

nessed but one, and that only in part. The "Intercollegiate Commemoration Exercises" began with a procession of some score presidents and delegated professors arrayed in full "academic costume." The sentiments aroused by it banished all desire to remain. (The following discourses, however, were admirably reported and were read afterward with interest and enlightenment.)

At Cornell University, some years ago, as a member of a committee on the subject, I cooperated in preventing the adoption of an arbitrary requirement; when, nevertheless, parti-colored ceremonial garments were worn by most of my colleagues, I excused myself from commencement exercises; hence I was quite unprepared for the gorgeous spectacle at Mt. Holyoke.

I tried to comprehend how mature, modest, civilized and learned persons could don garments indicating, on the one hand, an assumption of superiority and, on the other, a childish delight in bright colors and startling combinations (one was so "loud" that it seemed doubtful if the wearer could make himself heard). Nor could I refrain from speculating as to how far the addition of feathers and paint might complete the barbaric *ensemble*, arouse more keenly the curiosity of the uninitiated, and more effectually dazzle the eyes of groundlings.

Since then there have been sent me colored plates of the various academic costumes according to British and American usages, some courteous letters and offers of fuller information, and a pamphlet entitled "The International Bureau of Academic Costume, Albany, N. Y., July 27, 1902." To those interested I commend the paragraphs in that publication at the middle of page 5 and near the top of page 11. Candid and careful consideration of the claims there made confirms the opinion formed when the subject was first broached, viz., excepting, perhaps, the plain gown for the first degree, obviating social distinctions, the so-called "academic costume" is ostentatious, needless, childish or barbaric, and inappropriately expensive; its rapid and general

adoption, so far from evidencing its intrinsic value and probable permanence, exemplifies the survival of simian proclivities in the human race, and swells the category of peculiar "college customs" which, like the Indian of the traditional cowboy, are good only after they are dead.

It may be urged that educators constitute a "standing army" in conflict with ignorance. But there is no real analogy between their duties and those of soldiers, firemen and police.<sup>1</sup> Farmers combat the hunger of the community; physicians, disease; lawyers, misapprehension, injustice and crime; clergymen, the ape, bull and tiger in man; and all good citizens are in constant warfare with the undesirable elements of society; but these groups do not proclaim themselves by needless, conspicuous and costly Pharisaic habiliments.

According to the official pamphlet named above the prices of the "hooded gown" for the master's degree range from \$35 to \$85; those for the doctorate, \$10 more. For some classes such an outlay for garments to be worn upon comparatively infrequent occasions might not be excessive. But, until recently, most college professors, excepting such as had independent means or no families, were pleading with reason and commonly in vain for compensation that might enable them to provide for a less productive period of life. Now that the specter of retirement-penury has been exorcised by the bounty of Andrew Carnegie is it any the more becoming in his beneficiaries to indulge in a costly revival of medieval flummery?<sup>2</sup>

<sup>1</sup> It is not denied that occasions might arise when uniforms indicative of ordained pedagogic authority might prove useful in quelling disorder and averting destruction of property as, *e. g.*, at the recently reported *ante factum* football demonstration in the dining hall of a great university; the writer believes, however, that in all such cases a well-disciplined and fully supported fire department would act more appropriately and effectively.

<sup>2</sup> A somewhat comparable condition confronts former officers of the United States Volunteer Army in respect to membership in the "Military Order of the Loyal Legion." The initiation fee

The foregoing considerations are submitted in the hope that reflection upon them may lead some, especially among the younger scientists, to resist the temptation to "follow the fashion." They would better imitate the elder Agassiz; he received many foreign decorations; yet I never saw them displayed or witnessed in his demeanor or dress any feature suggesting a distinction between himself and the average American citizen.

BURT G. WILDER,

*Emeritus professor in Cornell University, and formerly surgeon of the Fifty-fifth Regiment of Massachusetts Volunteer Infantry*

WASHINGTON, D. C.,  
November 25, 1912

#### THE LATE DR. EDWIN TAUSCH

TO THE EDITOR OF SCIENCE: Permit me to call attention to a sad case of the widow and children of a man eminent in science—a case well worthy of charitable help from those who are able or disposed to give. Dr. Edwin Tausch, a young German, graduate in psychology from one of the German universities, was professor in Ohio University at Athens, and afterwards because of failing health, accepted the chair of psychology and philosophy in Willamette University, Salem, Oregon, but was obliged to give up this work on account of heart troubles, and finally during the past is \$35 and the annual dues for residents, \$12. Unlike retired officers of the regular army volunteer officers (unless more or less disabled by wounds or disease) receive from the government only a moderate pension proportionate to their age and length of service. Even this is of real help to many. Probably others besides the writer feel that the essential requirements and objects of the "Loyal Legion," viz., a modest badge, clerical service, and aid to the needy, might be provided for at a far less initial and yearly expenditure, and that conformity to the present scale is burdensome for many and unbecoming the beneficiaries of the nation. I resist the temptation to animadvert upon the showy, complex and cumbersome dress uniform and equipment of army officers as incongruous with the ideal of the professional soldier as a component of an efficient fighting machine.



summer died, leaving a wife and two children almost penniless in Germany. It is almost impossible for Mrs. Tausch to support herself and her children in that country and unless she can do so the children will be placed in an orphanage. It is her wish to find means for herself and her children to return to America where the children were born and where she herself would be able to find work as a teacher. In Germany "hundreds like herself are already waiting for a position wherever there is an opening." Dr. Tausch published a number of valuable papers, notably a sympathetic review of Dr. James's "Pragmatism." A study of the psychology of Tolstoy is still unpublished, as well as an extensive volume on pragmatic philosophy. Should any one feel like granting aid to the widow of this gifted but unfortunate scholar money may be sent through the writer or to Madam Elizabeth Tausch, care Frau von Wissman Warkotsch Kreis, Strehlen, Schlesien, Germany.

DAVID STARR JORDAN

LELAND STANFORD JUNIOR UNIVERSITY

#### SCIENTIFIC BOOKS

*The Humble-Bee, its Life History and How to Domesticate it, with Descriptions of All the British Species of Bombus and Psithyrus.* By F. W. L. SLADEN. London, Macmillan & Company, Limited. 1912. Pp. xiii + 283; 6 plates and 33 text figures. \$1.50 net.

This account of the life-history of the humble-bee will be more than welcome to every entomologist and student of animal behavior, not only because it is written by an eminent authority on the honey-bee, but because it is one of those rare nature books that are the mature fruit of a life-long interest and occupation. The author is so intimately acquainted with every detail in the daily and seasonal life of the British humble-bees and its parasites, and handles his subject in such a clever and fascinating manner, that one may fail to appreciate the great amount of patient observation and toilsome experimentation on which his statements are based. With true British independence he refrains from annoy-

ing and confusing the reader with citations of the large and scattered literature of the subject. Almost the only continental work he cites on the habits of the humble-bee is the classic memoir of Hoffer, "Die Hummeln Steiermarks," published thirty years ago (1882). The more recent work of Wladimir Wagner, "Psychobiologische Untersuchungen an Hummeln mit Bezugnahme auf die Frage der Geselligkeit im Tierreiche," *Zoologica*, Heft 46, I. and II., 1906 and 1907, is not even mentioned, and one familiar with this work may be pardoned if he secretly hopes that Sladen has never seen it, not because it is devoid of considerable merit, but because its spirit gives one reason to suspect that Sladen might have become sophisticated by its perusal. There is, indeed, no better way of appreciating the English author's work than by following it with a perusal of Wagner. Both authors have independently discovered and described a number of important peculiarities in humble-bee life that were unknown to Hoffer, but how different is the view-point from which their observations are made! In Sladen's work the humble-bee is the heroine of the story. She moves before us in all the glory of her regal, velvety attire, with the joyous or apprehensive hum of incessant, arduous labor and self-sacrificing motherhood. In Wagner's account it is Wladimir Wagner who occupies the foreground as the somewhat bumptious scientist who looks at the humble-bee, makes an observation, forthwith settles its connection with some lop-sided hypothesis, incidentally belabors a few contrary-minded, or bestows his approval on a few like-minded students of animal behavior, and then repeats the process. Sladen, on the other hand, writes with charming, sympathetic insight, and utterly unmindful of committing one of the most deadly sins that it is possible for a modern student of animal behavior to commit, pens such sentences as the following, in which the italics are the reviewer's: "The queen's *intelligence* is seen at its best while she is thus *caring* for her brood, and her *devotion* to it, and her *alertness* on the slightest approach of danger, are most interesting to witness. She shows



no desire to escape unless she is severely molested and is quite *content* with her brood, *anxiously* incubating it day and night." This is the way Wagner, who is beset with a terrible anxiety lest he commit this deadly sin of "grober Anthropomorphismus," describes the behavior of the same insect: "Eine nicht weniger auffallende Erscheinung ist der Versuch der Hummel, das Nest auszubessern. Erregt durch das eindringende Licht, steigt sie von der Wabe auf den Boden herab und kriecht rückwärts zu derselben zurück, wobei sie die bei solchen Gelegenheiten üblichen Bewegungen des 'Zusammenscharrens' trockener Pflanzenteile ausführt, d. h. nicht nur Bewegungen macht, deren Bedeutung sie nicht versteht, sondern nicht einmal im stande ist, auch nur die geringsten Resultate ihrer Tätigkeit wahrzunehmen, welche sie nur aus dem Grunde ausübt, weil diese Tätigkeit eine Reaktion auf die Gesamtheit der äusseren Reize darstellt." Surely, if we may ask Sladen how he knows that the humble-bee experiences anything akin to the affection and solicitude of the human mother for her offspring, we may also ask Wagner how he knows that such a highly organized insect as the humble-bee is a mere machine and absolutely unable to appreciate the results of any of her activities. Such quotations reveal the difference between Sladen's and Wagner's methods of observation and incidentally between the two schools of animal behavior which they represent. To one the insect is a wonderful and inexhaustible living organism, whose activities can be most satisfactorily described in the language which we employ when speaking of another individual of our own species; to the other the insect is a pure mechanism, whose every movement is easily expounded by the observer, who stands in the foreground and uses the observed object largely as a means of displaying his own analytical and explanatory acumen. The student of animal behavior, who wishes to appreciate the merits and defects of each of these methods, can hardly do better than to read in close sequence Sladen's and Wagner's memoirs on the humble-bee.

Sladen's book begins with a brief introductory chapter on humble-bees in general, their geographical distribution, their relations to flowers and their more important external characters. This is followed by a beautiful account of the life-history of the British species, with excellent figures of their nests, illustrating the behavior of the queen in establishing the colony, and the growth and arrangement of the brood-comb and of the honey- and pollen-pots. The author's interesting and original classification of the British *Bombi* as "pollen-storers" (*B. lapidarius*, *terrestris*, *lucorum*, *soroënsis*, *pratensis*, *jonellus*, *lapponicus* and *cullumanus*) and "pocket-makers," which are subdivided into "pollen-primers" (*B. ruderatus*, *hortorum*, *latreillellus* and *distinguendus*) and "carder-bees" (*B. deshamellus*, *sylvarum*, *agrorum*, *helferanus* and *muscorum*) is described and illustrated in detail. The third chapter, devoted to the "usurper bees" of the genus *Psithyrus*, carries us well beyond the researches of Hoffer and gives us the complete life-history of these extraordinary parasites. As ascertained by Sladen, this life history resembles in the most striking and suggestive manner that of certain parasitic ants of the genera *Polyergus* and *Bothriomyrmex*, since the female *Psithyrus* usurps the position of the *Bombus* queen by killing her and securing adoption by her workers, which then assist the parasite in bringing up her brood.

The fourth chapter takes up the other *Bombus* parasites and enemies. These constitute a very large and motley assemblage of organisms, including the meadow mice, a peculiar wax-moth (*Aphomia sociella*) which devours not only the cells, but also the brood of the humble-bee, a Tachinid fly (*Brachycoma devia*), the highly mimetic *Volucella bombylans*, besides several other Diptera belonging to the genera *Fannia*, *Phora*, *Conops*, etc., several Hymenoptera, especially *Mutilla europæa*, certain Braconids and ants, more than 50 species of Coleoptera, among which *Antherophagus nigricornis*, a small beetle that is carried from the flowers, into the nests attached by its mandibles to the proboscis of the bee, is one of the most interesting, several

mites, a singular Nematode worm, *Sphaerularia bombi*, which lives in the abdomen of the queen, and a Microsporidian belonging to the genus *Nosema* and allied to the *N. apis* recently shown to be the cause of the "Isle of Wight disease" of the honey-bee. Several of these parasites may simultaneously attack a colony of humble-bees and completely destroy it in a very short time. The reviewer, on August 18, 1909, found under a stone at Zermatt, Switzerland, a small alpine humble-bees' colony which had been utterly wiped out by no less than three of these parasites. The cells and brood had been devoured by a mass of wax-moth larvæ (*Aphomia*) which were nearly ready to pupate. Among these lay a number of puparia of the Tachinid *Brachycoma*, while perched on the top of the nest among four dead and dying humble-bees was a fine female *Mutilla europæa*. It is certainly remarkable that notwithstanding the inroads of all these parasites and prædators and the small size of the colonies compared with those of many other social insects, the humble-bees, nevertheless, manage not only to survive, but to maintain their position among the commonest insects of the north temperate zone. And this dominance of the genus *Bombus* is even more surprising when we stop to consider that its species very easily succumb to excessive moisture, especially in countries like Great Britain.

Chapters V. to VII. of Sladen's work treat of the practical methods of studying the humble-bees, of finding and taking their nests, of the construction of artificial or observation hives, and of attracting to the latter the overwintered queens. In these chapters, which show how Sladen acquired his intimate knowledge of humble-bee behavior, we can also detect the advantages he has secured from his practical study of the honey-bee. By "domestication" he means merely the bringing of the humble-bee into the same relations to man as those obtaining in the case of the honey-bee. In the proper sense of the term, of course, neither of these insects can be domesticated.

The eighth chapter of the work is devoted

to the taxonomy of the British humble-bees and is illustrated by five fine colored plates, showing the males and females, and a plate of line-drawings, showing the male genitalia, of the 17 species of *Bombus* and six species of *Psithyrus* known to occur in Great Britain. The work concludes with a short chapter on making a collection of humble-bees, one containing a number of interesting notes and anecdotes and a brief appendix with some additional miscellaneous observations. It is certain that this volume will long remain a classic and an inspiration not only to British students of humble-bees, but to many of our entomologists, whom its perusal should encourage to acquire an equally intimate knowledge of the practically all but unknown habits of the numerous North American *Bombi*.

W. M. WHEELER

*The Snakes of South Africa: Their Venom and the Treatment of Snake Bite.* By F. W. FITZSIMONS. With 193 figures, mostly original photographs. New edition. Cape Town and Pretoria, T. Mashew Miller; New York, Longmans, Green & Company. Pp. xvi + 547.

This book is a natural history of South African snakes that, while written in a popular way and primarily for South Africans, and mainly devoted to the relations of the poisonous species to man, deserves to be brought to the attention of students of herpetology. The writer attempts to acquaint the residents of South Africa with the general habits of the snakes of their region, and to point out to the general reader, in simple language, the possibilities of being bitten by a poisonous snake, the action of the venom, and the best treatment that the investigators of the nature of snake venom have worked out.

As the principal aim of the book is thus to educate the non-scientific readers in a region where venomous snakes abound, one can not quarrel with the author for devoting considerable space to the poisonous species, even though his only original contributions to this subject are the results of investigations of the toxicity of the South African species. There



is nothing of interest to the student of herpetology in the first two chapters, on the classification, evolution, history, distribution, general habits and identification of species of snakes, and the chapter on snake charmers, Kafir superstitions, etc., and the one on human physiology may also be ignored.

On the other hand, the herpetologist will find much of interest in the accounts of the habits of different species. The writer is evidently a careful field observer, and his descriptions of the feeding and breeding habits of certain forms are a distinct contribution. For example, the description of the feeding habits of the puff adder (p. 225) could hardly be improved. A very notable feature also is the numerous photographs of snakes, both in their natural haunts and in captivity. The series showing a specimen of *Dasypeltis scabra* eating an egg and ejecting the shell, and the photographs of the mole snake, ringhals cobra, and puff adder with newly born young are notable, and there are many others of equal interest. There is also a considerable amount of information on the habitat preferences of various forms that will be useful.

The author is to be commended for the care exercised in guarding against the errors that are so liable to occur in a popular account. The word skin is rather loosely used for the stratum corneum in the account of sloughing (p. 16); snakes do frequently eat dead animals in nature (p. 40); it is doubtful if many naturalists still hold the opinion that the fangs of opisthognaths are primarily for holding the prey (p. 139); and the toad is not a reptile (p. 227). It is rather surprising that the writer advocates sucking the wound made by the bite of a venomous snake, since this is dangerous unless one is sure that there are no abrasions about the mouth, and Noguchi asserts that the procedure is quite useless. It may be added that the author's style is rather tautological, there is some irrelevant matter, and a closer grouping of the subject matter would be advantageous.

The reviewer would suggest that an easy key to the South African species would much increase the value of the book. It is doubtful

if many persons would take the trouble to dissect out the jaws to identify the species; at any rate it would not be easy to use the author's key, scattered as it is over several chapters.

ALEXANDER G. RUTHVEN

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*General Physics.* By W. WATSON, F.R.S.  
Longmans, Green & Co. 564 pages, with 311 figures and diagrams.

It is a very interesting fact that Professor Watson, who has given to us the comprehensive "Text-book of Physics" with its nine hundred and fifty pages, should find it necessary to arrange another text to meet the needs of "engineering, medical and other students." Not only has he condensed and rearranged his larger work, he has placed the emphasis on different topics and has omitted many. Among these may be noted the discussion of the energetics of a voltaic cell and that of Maxwell's electromagnetic theory. Fifty pages in the older text are given to electrolysis and electric cells where only sixteen are required in the new text. The three hundred pages given to electricity and magnetism in the older text have here been cut in half, notwithstanding the fact that much new matter is added on account of the discussion of radioactivity and wireless telegraphy.

It is rather probable that the newer text will suit the needs of a larger number of instructors in general physics in American colleges than did the older text. For it can be said that the table of contents includes all the main essential principles of physics with a reasonable number of applications to the affairs of every-day life. The presentation is direct, matter of fact, concise, clear. There is no time or space for the spectacular or ornate. The author, being an Englishman, does not give an explanation, right or wrong, of the curving of a base ball, nor of a tennis ball—though had he done so he might have claimed that he was but following the example set by the illustrious Newton. Nor is the mono-rail car discussed. But in America



these omissions are not as serious as they are in England, for here one can probably find them discussed in the Sunday editions of the daily papers!

There are some omissions, however. In the chapter on radiation no mention is made of the sensitive instruments for detecting and measuring radiant energy—the thermoelement, the radiometer, the bolometer. In fact, the discussion of radiation is rather inadequate. In the chapter on the interference of light several pages are given to the discussion of Fresnel's mirrors and biprism, but no mention is made of the interferometer, although the latter is as important theoretically as the former and vastly more important in its numerous applications to exact measurement.

In the chapters devoted to heat, however, admirable illustrations of the application of the principles to modern heat engines are given. In electricity, too, the points of contact of the subject with the world of to-day are shown.

In a book where so much material is presented in so few pages the method of approach is abrupt and the style at times uninteresting. The text will not find favor with those teachers who place emphasis on the inductive aspect of the science nor will it be pleasing to those students who look for entertainment in their reading, but it is a very dependable, clear and fairly complete statement of the principles of physics.

G. F. HULL

DARTMOUTH COLLEGE

*Essentials of Physics for College Students.*

A Text-book for Undergraduates and a Lecture Course and Reference Work for Teachers and Other Students of Physics. By DANIEL W. HERING. The D. Van Nostrand Co. 353 pages, with 166 illustrations.

The author tells us in the preface that the work is the outgrowth of a course of lectures which he has delivered for several years past to undergraduate students, and that it is intended for that class of students preparing to fill the position of educated men and women who are not specialists in science. As the

contents of the book are intended to be presented in "sixty lectures of fifty minutes each" some rather important, perhaps essential, parts of the subject have received a very brief description. On the other hand, liberal space is given to some pseudo-philosophic topics. One notes that the author gives only two pages to the presentation and discussion of the mechanical equivalent of heat and the laws of thermodynamics. The connection between the absorbing and reflecting power of surfaces is given in two lines. But notwithstanding this brevity the author devotes the larger part of the first twelve pages to these captions or questions: Physics, is it or is it not a study of matter, ether and motion? Why study physics? Space, time, matter; Energy "a capability of matter." The best feature in this discussion is found in the definitions and statements quoted from Maxwell's "Matter and Motion."

A couple of pages are given to the discussion of *inertia* in which the author decides that one can no more measure the quantity of matter by its inertia than one can measure the size of a dead elephant by its deadness. This adherence to the notion that *inertia* is a property of matter which can not be represented quantitatively is not in accord with the custom of physicists. The terms *inertia* and *moment of inertia* are used quantitatively in physics. Such authors as Crew and Ames set forth in a very clear manner the mode of measuring the quantity of a bit of matter by its inertia or reluctance to change of linear motion. The author does not deal with the large topic of rotational motion, consequently he makes no reference to *moment of inertia*.

In dealing with the units involved in force and work the author brings in the engineer's system (footnote, p. 32): "If force be measured in pounds then the mass will be in pounds  $\div 32$  and work will be in foot-pounds." Had the equation of force been written  $F = kma$  instead of  $F = ma$  there would have been no necessity for this statement and the confusion it brings to students would have been avoided.

Apart from these criticisms the text is to

be commended for the clearness with which physical principles are stated, and for the numerous workable and practical problems. That part of the text dealing with lenses and with problems concerning the eye is especially to be commended.

One feature of the text which distinguishes it from others is the grouping together of descriptions of demonstration experiments at the end of each chapter. This is a matter of considerable convenience to an instructor and should prove interesting to a student. Another commendable feature is the large number of references to, or quotations from, other texts or original articles.

The author apparently has not attempted to condense as great a number of facts and principles as possible into the text, but has attempted to present in an interesting form what appears to him to be of most importance, and he has succeeded. As a piece of book-making the text is excellent.

G. F. HULL

DARTMOUTH COLLEGE

#### SPECIAL ARTICLES

##### THE NUTRITIVE VALUE OF THE PROTEINS OF MAIZE

THE state of knowledge at present prevailing concerning the nutritive value of corn-meal when fed to domestic animals is clearly presented in a letter which I recently received from Professor Willard, of the Kansas Agricultural College, who has had a wide experience with practical feeding experiments made on a large scale on domestic animals. He says:

It is a matter of common experience extending over many years, that corn appears to be deficient in some particular in nutritive value. Some have thought to account for this on the basis of low protein content; others have attributed the result to its small percentage of ash; still others have taken into account not only the small percentage of ash, but its unbalanced character, being deficient in calcium and possessing a large percentage of magnesium; still more recently there has appeared the possibility that the defect may find an

explanation in limitations in the amino-acid components present in the corn protein.

From this quotation it is evident that further study is needed in respect to the relative nutritive value of the constituents of this seed. Professor Mendel and I have recently obtained preliminary results from feeding maize proteins to white rats under conditions similar to those which I described at our fall meeting last year.

The proteins of maize have not received the attention that their great economic importance demands, for these, the most valuable constituents of this seed, form from eight to ten per cent. of a crop which in this country alone is annually worth one and a half billion dollars. This is the more remarkable as those chemical investigations which have been made show that at least one half of the protein of this seed consists of a type possessing such unique chemical and physical characters as to make it probable that its nutritive properties differ to a marked extent from those of the proteins in other foods of either vegetable or animal origin.

In addition to this protein, known as zein, the maize kernel contains small quantities of globulins, albumins and proteoses and also protein substance insoluble in neutral solvents which can be extracted from this seed only by dilute alkalies. This latter protein has been named maize glutelin. According to such data as are at present available, zein forms about 58 per cent. of the proteins of corn, the globulins, albumins, and proteoses together about 6 per cent., and the remaining 36 per cent. is supposed to be maize glutelin.

The few recorded attempts to determine the nutritive value of maize proteins, in the isolated state, have been made only with zein. The conditions under which these have been conducted have been such as to render the results of uncertain value, although in every instance zein, when supplied as the only protein, proved ineffective for maintaining adult animals or promoting the growth of the young.

Zein presents striking differences in its amino-acid make-up when compared with the other proteins commonly present in foods. The greatest interest has centered about the

<sup>1</sup>Read before the National Academy, November 13, 1912.



entire absence of tryptophane and lysine, for feeding experiments with zein were expected to shed light on the important question of amino-acid synthesis by the animal.

Maize glutelin, in contrast to zein, yields all of the amino-acids commonly found in proteins and in proportions corresponding to those yielded by the majority of animal or vegetable proteins.

The globulins, albumins, and proteoses occur in such small quantities that it has not been possible to obtain them in sufficient amount to determine their amino-acid make-up, or their value in nutrition.

and food intake, broken line, of several rats fed on our protein-free milk diet.<sup>2</sup> During period 2 all of these rats had a diet containing zein as its sole protein and, as you will note, they rapidly declined in weight, although the food intake remained nearly constant, or was even increased, as shown by rats 617 and 647. That this quantity of food was sufficient for maintenance is shown by rats 628 and 659, which regained part of their lost weight on an even smaller quantity of food after the zein had been replaced by gliadin. The increased food intake when zein was replaced by casein, edestin or lactalbumin is largely to be ascribed

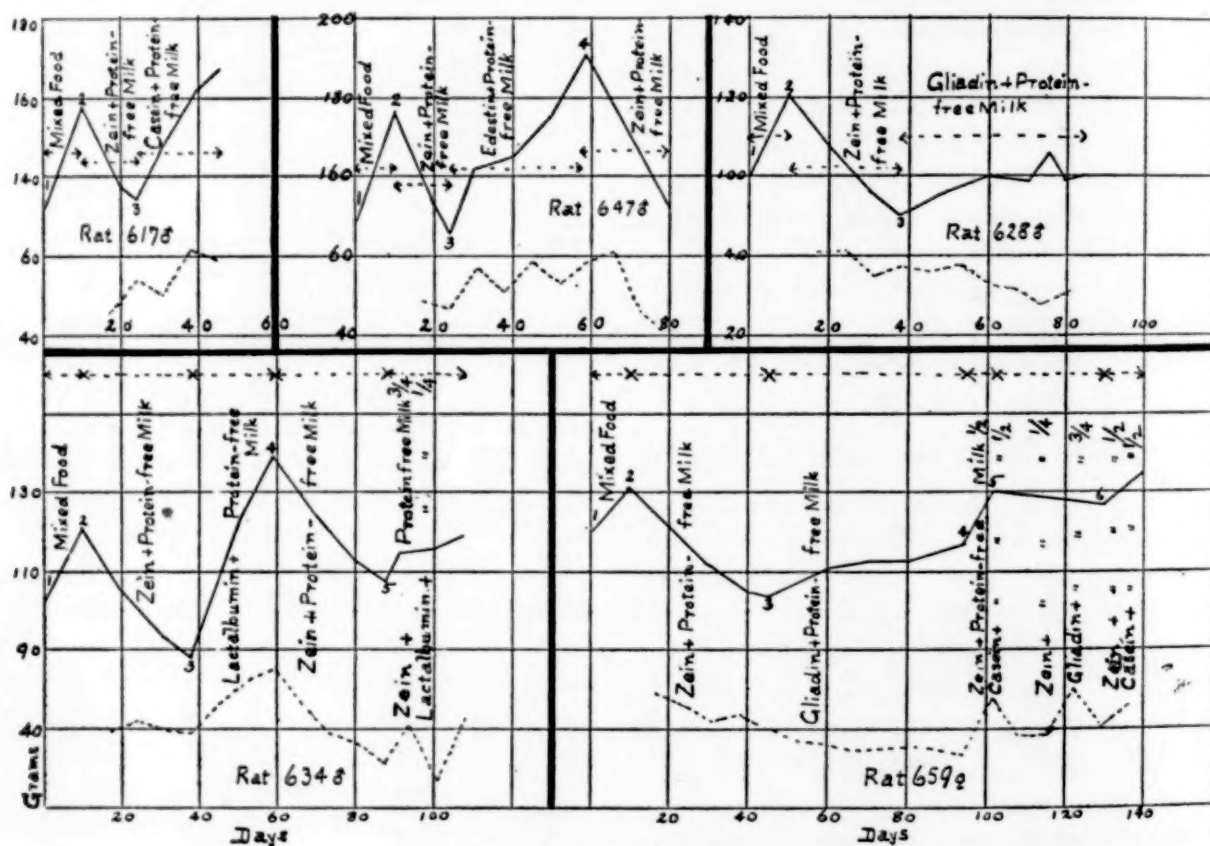


CHART I

Last fall the results of two experiments with mature rats supplied with food containing zein as its sole protein were described. In both cases the animals declined rapidly in weight, although their food intake remained practically constant. These results have since been confirmed by a large number of experiments, some of which are illustrated by the following charts.

Chart I. shows the body weight, solid line,

to the rapid gain in weight which took place when this change was made in the ration. It might be thought that a failure to digest and assimilate zein was the cause of the decline on the zein diet, but curves which you will see later show that can not be so, for the addition of a small amount of tryptophane renders the

<sup>2</sup> SCIENCE, N. S., Vol. XXXIV., No. 882, pp. 722-733, November 24, 1911.

zein food efficient for maintenance over a long period.

Our experiments show that there is a very great difference in the food value of different proteins. Thus we have complete nutritive failure with zein, maintenance with gliadin, and restoration of lost weight, or normal growth, with either casein, lactalbumin or

which is still in progress, indicates that the failure to grow, shown by rat 593, or by rats fed with gliadin, is not due to a lack of lysine in the protein. The fall in weight shown by these two rats at the beginning of the experiment is probably chiefly due to the less bulky experimental food, and the consequent smaller quantity of feces in the digestive tract.

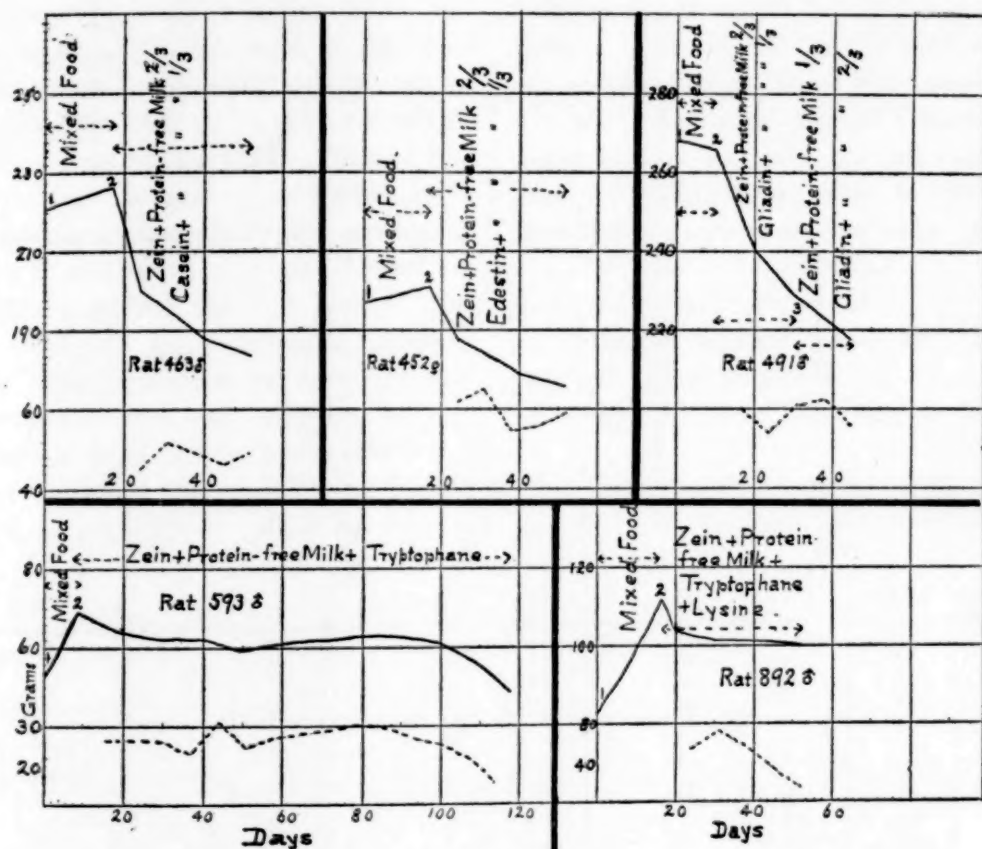


CHART II

edestin. These three latter proteins yield on hydrolysis both tryptophane and lysine, which zein lacks, whereas gliadin, which is incapable of promoting growth, yields tryptophane, but only a very insignificant proportion of lysine. Gliadin resembles zein in the proportion of amino-acids, other than tryptophane, but differs widely from casein, lactalbumin or edestin.

Chart II. shows that when a quantity of tryptophane corresponding to 3 per cent. of the protein is added to the zein food, the rat does not decline in weight, but is maintained without growth, just as if fed with gliadin. The curve for rat 892 likewise shows maintenance without growth. This experiment,

Charts I. and II. show that zein is incapable of maintaining rats, unless tryptophane is added to the diet, whereas on the other proteins, all of which yield tryptophane, they recover their lost weight, and grow at a normal rate except on gliadin. This raises the question whether or not the replacement of a part of the zein by other proteins containing tryptophane will render the ration effective in promoting growth. Unfortunately there is no method known whereby the amount of tryptophane in a protein can be even approximately determined. The nearest approach to an estimate of the relative amount is given by a comparison of the intensity of the color shown by the glyoxylic acid reaction. Such a compari-



son indicates that lactalbumin yields much more tryptophane than edestin, and that edestin yields somewhat more than casein or gliadin, which give reactions of about equal intensity.

We have made some preliminary experiments to determine the effect of replacing a part of the zein with other proteins, but these have not been continued long enough to give final conclusions. The three upper curves show that when one third of the zein is replaced by casein, edestin or gliadin the rat rapidly loses weight. The fall is less rapid and less extensive when one third of the zein is replaced by edestin than when it is replaced by casein.

Chart I., rat 634, shows that when one fourth of the zein is replaced by lactalbumin, weight is regained. Unfortunately this experiment was terminated by death from diseased lungs.

Chart III. shows that rat 633 regained its lost weight very rapidly when one half or one

So far as these results go they agree with the relative intensity of the glyoxylic acid reaction for tryptophane.

Chart IV. shows complete recovery of lost weight when one half of the zein was replaced by casein, and rapid decline when the proportion of casein was reduced to one sixth. This decline was at once stopped when tryptophane was added to the food, the proportion of zein and casein remaining the same. The last period of this experiment was unsatisfactory as the rat soon after died with diseased lungs and kidneys. If disease had not intervened it is not improbable that the lost weight would have been fully regained in period 4.

Chart V. shows a rapid loss of weight when zein formed the sole protein of the diet, and complete recovery when one half of the zein was replaced by casein. After being again reduced on the zein diet, a partial recovery was made when one half of the zein was replaced by edestin, and a nearly complete recovery, when all was replaced by edestin.

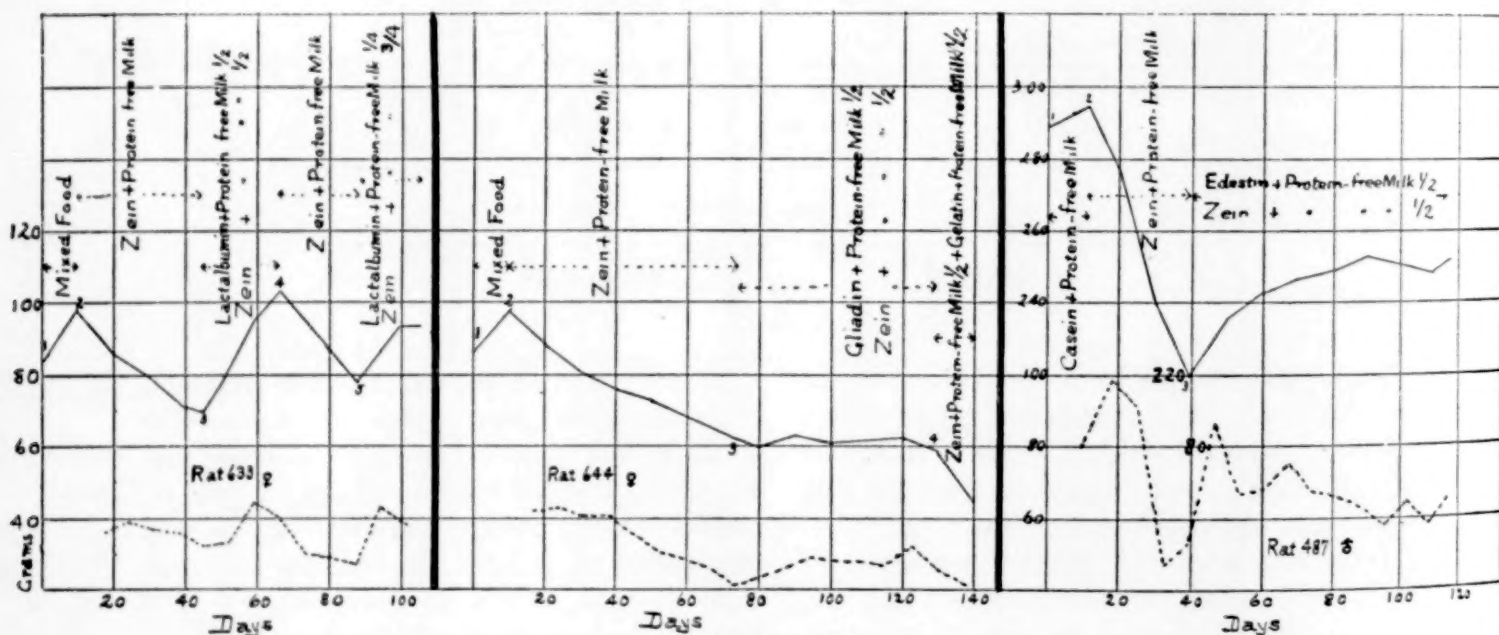


CHART III

quarter of the zein was replaced by lactalbumin. Rat 487 regained its loss more slowly with one half edestin. Rat 644 was maintained by one half gliadin, and declined rapidly and died when changed to a diet containing one half zein and one half gelatin, a protein which like zein lacks tryptophane.

It is difficult to understand why diets containing two thirds zein and one third casein or edestin are so inferior to those containing one half of either of these proteins. It may be that experiments now in progress will not confirm these preliminary results, but it is also possible that we shall find that a certain min-

imal quantity of tryptophane is essential for life, and that this is not supplied by these smaller proportions of casein or edestin.

Thus far the experiments I have described have been concerned with zein, which is only one of the proteins of maize.

formed the sole protein. On this diet the rat quadrupled its weight in 70 days, thus exceeding somewhat the average normal rate of growth of rats on natural mixed food. Rat 596 grew more slowly on a diet containing equal parts of zein and maize glutelin.

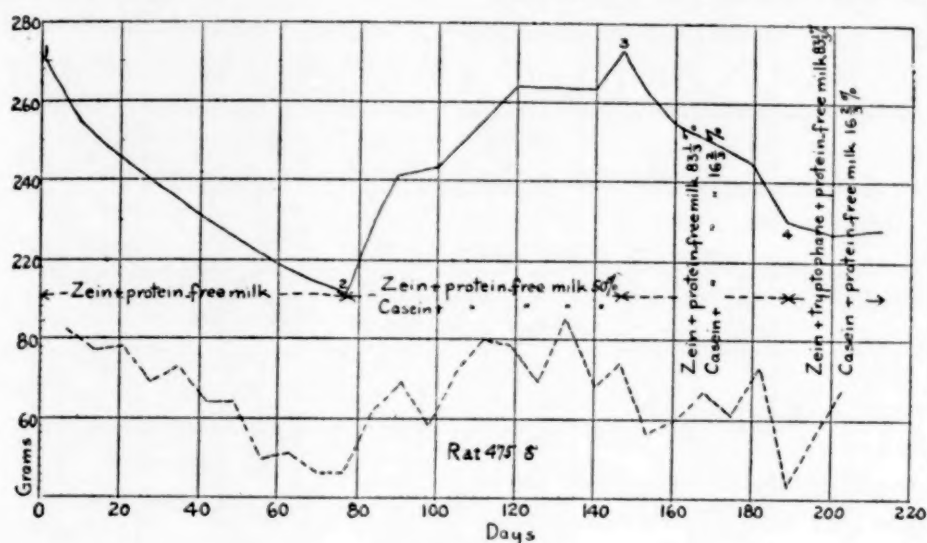


CHART IV

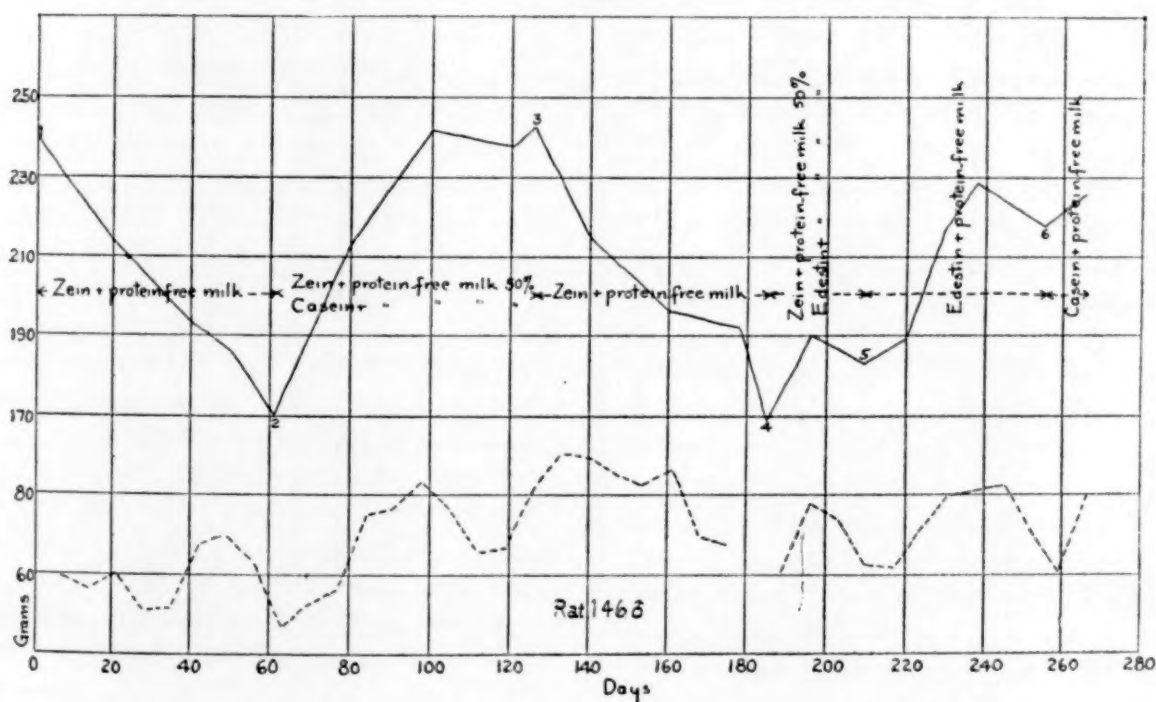


CHART V

Chart VI. shows that corn contains a protein which is capable of promoting normal growth. During period 2, rat 567 was fed with a diet containing the same non-protein constituents as those used in the preceding experiments, but in this food maize glutelin

Chart VII. shows the result of feeding rats with corn gluten. This substance is a product obtained in the manufacture of corn starch, and consists chiefly of zein and maize glutelin, which are separated from the corn by purely mechanical operations. With this



material we have an opportunity to study the nutritive value of the proteins before they have been subjected to the chemical operations incident to their isolation and purification. These curves show that the mixture of proteins in the corn gluten is capable of maintaining

imals. It is interesting to note that the weight lost by these animals was much more quickly regained when one half of the corn gluten was replaced by lactalbumin than by edestin, results which agree with those obtained by adding these proteins to the zein diets.

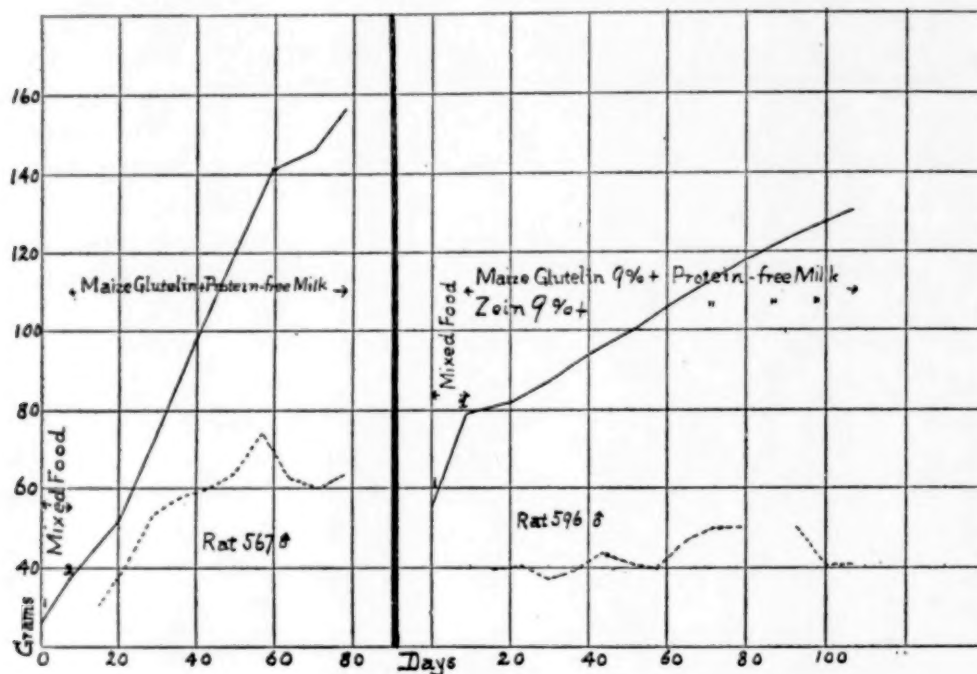


CHART VI

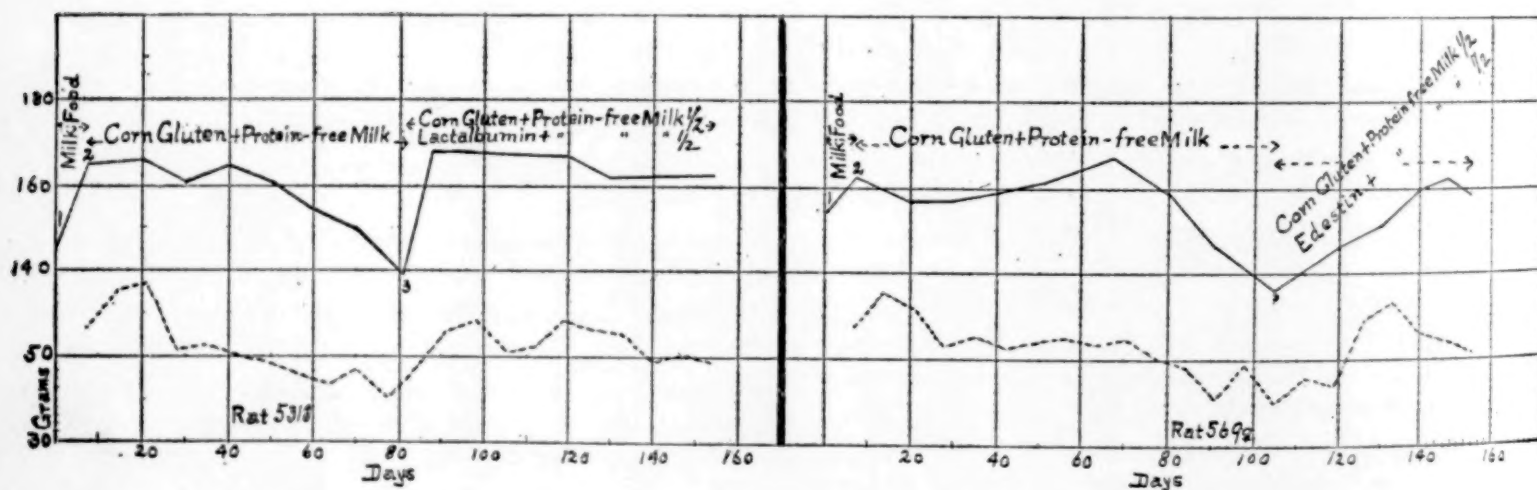


CHART VII

rats for some time. Unfortunately at the time these experiments were started our supply of stock rats was so low we were obliged to use rats which had been previously subjected to long-continued experimental feeding. Doubtless better results will be obtained when we repeat these experiments with fresh ani-

The results here presented leave no doubt that the deficiency observed in the practical feeding of cornmeal is explained largely, if not wholly, by the unique chemical constitution of zein which forms such a large part of its proteins.

Many more experiments must be made be-

fore the numerous questions raised by our feeding trials can be regarded as settled, and attention must finally be given to the relative food value of mixtures of various food stuffs with corn meal, so that we may know as definitely as possible the most economical combinations to employ in maintaining mature animals and in raising the young. Such experiments must be conducted on a large scale and with a variety of domestic animals. In carrying these out the results obtained by the method I have just described when combined with the experience gained in feeding animals for market will doubtless lead to a lower cost of meat production, and at the same time give us information which will contribute to a clearer understanding of some of the obscure problems of the chemical physiology of nutrition.

THOMAS B. OSBORNE

CONNECTICUT AGRICULTURAL  
EXPERIMENT STATION,  
NEW HAVEN, CONN.

#### DISCOVERY OF BIVALVE CRUSTACEA IN THE COAL MEASURES NEAR PAWTUCKET, R. I.

WHILE collecting fossils for the Museum of Comparative Zoology, Cambridge, from the Carboniferous graphitic slates of Central Falls, Rhode Island, last June, the writer discovered in a half inch layer at two localities one hundred yards apart about two dozen, more or less well preserved impressions of carapaces of bivalve crustacea of the genera *Leaia* and *Estheria*, in the same layer with numerous plant impressions, chiefly leaves of *Cordaitea* and *Calamites*. No record of their having been previously discovered in the Narragansett Basin Coal Measures was found by the writer, and no specimens of any bivalve crustacea occur in the collection of Coal Measure material from the basin, at Brown University or at Harvard.

The faunal remains from the Narragansett Basin Coal Measures are comparatively meager, and consist largely of tracks which are in many cases of doubtful determination. Previous to the year 1900, fourteen species of insects and one arachnid were identified by Scudder,<sup>1</sup> and the tracks of a probable annelid and of a mollusc or worm were described.<sup>2</sup> In 1900 A. S. Packard<sup>3</sup> described some prob-

able worm tracks, and those of a possible crustacean which were found in some red shale boulders at South Attleboro. He described and named another track found in a pebble of arenaceous shale in a kame in North Providence, and three fragments of a possible macrurous crustacean from the black shales of Valley Falls, R. I., and noted a locality near East Attleboro, shown to him by Professor J. B. Woodworth, where sand-filled worm borings occur in the red and green shales. He also described and identified several casts of valves of a fresh-water mollusc *Anthracomya arenacea* (Dawson) Hind, from a boulder of fine black shale at Valley Falls, and one specimen from a shale bed north of Silver Spring, East Providence.

Numerous supposed amphibian tracks have been found by Professor J. B. Woodworth near Plainville, Mass., and one species, *Batrachichnus plainvillensis*, has been described<sup>4</sup> and named by him. Since then he and the writer have found many types of tracks from several localities near Plainville, and these will probably be described in detail soon. Two or three tracks of probable amphibia were found by Professor Woodworth and the writer last June at Valley Falls and Central Falls, R. I., which is very much south of the localities where they have been previously noted.

From this brief summary of the occurrence of the fossil fauna, it will be seen that only a part of the specimens have been found *in situ*, and the majority of these are tracks. The discovery of these bivalve crustacea in place is therefore of considerable importance.

The impressions of the valves of *Leaia* and *Estheria* occur in a grayish black, somewhat graphitic slate bed along the south bank of the Blackstone River in Central Falls, R. I. The beds strike N. 70°-80° E. about parallel with the river at this place, and dip 70° N.

<sup>1</sup> Bull. U. S. Geol. Survey, No. 101, 1893.

<sup>2</sup> *Proc. Bost. Soc. Nat. Hist.*, XXIV., 1889, pp. 209-216, and *Amer. Jour. Sci.*, 3d Ser., XXXVII., 1889, p. 411.

<sup>3</sup> *Amer. Acad. Arts and Sci. Proc.*, Vol. XXXV., 1900, pp. 399-405.

<sup>4</sup> *Geol. Soc. Am. Bull.*, Vol. IX., 1900, pp. 449-454.



The section consists of alternating slate and gray sandstone layers, of a few feet thickness. The slate usually has numerous fossil plant impressions in it, but the sandstone here is barren of recognizable organic remains.

The specimens of the genus *Leaia* Jones, are in general well preserved and show the surface markings distinctly (see Fig. 1).



Fig. 1. X 2.



Fig. 2. X 2.

They correspond closely with the description and figures of *Leaia tricarinata* Meek and Worthen,<sup>3</sup> of the Illinois and Indiana Coal Measures. The size of an average specimen from Rhode Island is: length, 8.5 mm.; height, 5 mm. The presence of a well-marked third carina along the dorsal margin and the twelve to sixteen slender concentric ridges, as well as the agreement in size, make it seem safe to call the Rhode Island specimens *Leaia tricarinata*.

Several specimens of the genus *Estheria* Ruppel occur in the same layer with *Leaia* (see Fig. 2). They vary slightly in size and proportions, but all show the generic characters well. The surface markings are not as distinct as in the specimens of *L. tricarinata*, but most of the *Estheria* specimens show from nine to thirteen faint concentric striae. The size of an average specimen from Rhode Island is: length, 7 mm.; height, 5 mm. The specimens are not sufficiently well preserved to permit of a specific determination.

In the Conemaugh Series of the Carboniferous of Pennsylvania, Dr. P. E. Raymond<sup>4</sup> has noted the presence of *Estheria* and *Leaia tricarinata*, with plant remains, in a red and gray shale layer occurring just below the Ames limestone, which is midway in the Conemaugh Series. Fossils of the two genera occur in several horizons of the Coal Measures. In Illinois *L. tricarinata* ranges from the

lower part of the Lower True Coal Measures, to high up in the Upper Coal Measures, therefore neither genus is a good horizon marker. If we regard the *Estheria*, *L. tricarinata* horizon of the Conemaugh Series as of the same age as that at Central Falls, R. I., we should then be calling this horizon of the Narragansett Basin Series the equivalent of the middle of the Lower Barren Measures of Middle Pennsylvanian age.

WINTHROP P. HAYNES

CAMBRIDGE, MASS.,

October, 1912

#### THE ELECTROMOTIVE FORCE PRODUCED BY THE ACCELERATION OF CONDUCTORS

THE possibility that electromotive forces may be produced by the mechanical acceleration of electric conductors was first thoroughly considered by Maxwell,<sup>1</sup> and the actual presence of such electromotive forces in *electrolytic* conductors was shown by Colley<sup>2</sup> in 1882.

The desirability of obtaining similar electromotive forces in accelerated *metallic* conductors has long been recognized by the writer. At a meeting of the Harvard and Massachusetts Institute of Technology Physical Chemical Society, held at the Harvard Union in the spring of 1906, he stated that a potential difference was to be expected between the front and rear ends of a metallic conductor which is suddenly stopped, since there will be a tendency for the electrons to continue in motion. Since that time he has often spoken to his colleagues, both privately and at informal scientific meetings, of the desirability of making measurements of this kind in order to obtain information as to the mass of the carrier in metals, and in particular has described as a possible form of apparatus a coil of wire oscillating about its own axis with some form of commutator to permit the detection with an ordinary galvanometer of the alternating current which would be generated.

During the past year at the University of Cincinnati, with the help of his assistant, Mr. Earl W. Osgerby, the writer has carried out

<sup>3</sup> *Geol. Surv. Ill.*, Vol. 3, pp. 541-543.

<sup>4</sup> *Ann. Carnegie Mus.*, Vol. V., No. 2 and 3, 1909, p. 173.

<sup>1</sup> Maxwell, "Treatise on Electricity and Magnetism," 3d edition (1892), Vol. II., 211 et seq.

<sup>2</sup> Colley, *Wied. Ann.*, 17, p. 55, 1882.

an elaborate series of measurements on the electromotive forces produced by the acceleration of electrolytes, varying the nature of the solutions used, the magnitude of the acceleration, and the distance between the front and rear electrodes, and is now preparing for publication a description of the work. The experiments were performed, however, primarily as a preliminary to similar work with metals in order to test the quantitative theory as to the magnitude of the effect which would be much larger in electrolytes than in metals, and in order to determine the most suitable form of apparatus for the work. Mr. Osgerby and the writer did, however, carry out some experiments with metallic conductors, but at the time were unable to detect any effect, as further modification of the apparatus is necessary before it will be sensitive enough for metals.

In a recent number of *SCIENCE* (November 1, 1912) the writer was surprised to observe that Professor Daniel E. Comstock, of the Massachusetts Institute of Technology, has not only apparently attempted to reserve this field of experimental investigation, but to put forward as a new discovery the probability that such electromotive forces would be produced by the acceleration of metallic conductors. The possibility of such electromotive forces has certainly been recognized since the time of Maxwell. In *electrolytic* conductors their actual presence has been shown by the experiments of Colley, and the similar electromotive forces which arise from the action of centrifugal force on electrolytic conductors were demonstrated by Des Coudres<sup>3</sup> and have been thoroughly investigated by the present writer.<sup>4</sup> In another, to obtain effects dependent on the *metallic conductors* Maxwell,<sup>5</sup> Lodge,<sup>6</sup> and Nichols<sup>7</sup> have all attempted, by one method or

another, to obtain effects dependent on the "mechanical momentum" accompanying the passage of electricity, but have failed, owing to the lack of sensitiveness of their apparatus. That the conception of "free electrons" necessarily includes the production of an electromotive force in accelerated metals is certainly the common knowledge of physicists who are familiar with the work of the above investigators.

The writer has no desire to reserve a field which is the property of all physicists, but at the present time wishes to report that his experiments are sufficient to show, as would be expected, that the electromotive force produced in accelerated metals is certainly much smaller than that produced in accelerated electrolytes, and to state that the apparatus is now being improved with the hope of detecting the effect in metals.

RICHARD C. TOLMAN

UNIVERSITY OF CALIFORNIA,  
November 9, 1912

#### THE AMERICAN SOCIETY FOR PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS

THE fourth annual meeting of the society was held in Cleveland on December 30 and 31. There were two executive and three scientific sessions.

The most important outcome of the Cleveland meeting, as far as the Pharmacological, Physiological and Biochemical Societies are concerned, was the formation of a federation designed to knit these societies more closely together, while yet jealously preserving the individuality of each component. The meeting of delegates with full power to act from each of the three societies, took place during the last informal dinner and smoker at the Colonial Hotel on December 31. The delegates from the Physiological Society were Drs. Meltzer, Lee and Cannon; from the Biochemical Society, Drs. Lusk and Wells; from the Pharmacological Society, Drs. Sollmann, Loevenhart and Auer.

Dr. Meltzer was elected temporary chairman and Dr. Cannon temporary secretary. The outcome of the proceedings of this conference committee will be best shown by a transcript of its minutes:

"The following motions were voted unanimously:

"That a federation of the three societies be hereby established.

<sup>3</sup>Des Coudres, *Wied. Ann.*, 49, p. 284, 1893; *ibid.*, 57, p. 232, 1896.

<sup>4</sup>Tolman, *Proc. Amer. Acad.*, 46, p. 109, 1910; *J. Amer. Chem. Soc.*, 33, p. 121, 1911.

<sup>5</sup>Maxwell, *loc. cit.*

<sup>6</sup>Lodge, "Modern Views of Electricity," 3d edition (1907), p. 89.

<sup>7</sup>Nichols, *Physik. Z.*, 7, p. 640, 1906.



"That the presidents and the secretaries of the constituent societies form the executive committee of the federation.

"That the chairmanship of the executive committee be held in turn by the presidents of the constituent societies who shall succeed one another annually in the order of seniority of the societies (physiological, biochemical and pharmacological).

"That the secretary of the executive committee shall be secretary of the society whose president is chairman.

"That the secretaries of the three societies shall consult in preparing the programs of the annual meeting, and that, as far as practicable, and with the author's consent, papers be so distributed as to be read to the society in which they properly belong.

"That the programs of the three societies be published by the secretary of the federation under one cover and that the expense of publication be shared *pro rata* by the societies according to the number of members.

"That the official title of the new organization be 'The Federation of American Societies for Experimental Biology' (comprising the American Physiological Society, the American Society of Biological Chemists, and the American Society for Pharmacology and Experimental Therapeutics).

"That a common meeting place of the federation with the Anatomists, Zoologists and Naturalists is desirable but not mandatory.

"That in the name of the federation, the International Physiological Congress be invited to meet in the United States in 1916.

"That the present conference committee delegate all its powers to the executive committee of the federation.

"The meeting then adjourned."

The first meeting of the new federation will be held next December in Philadelphia.

The scientific program was as follows:

#### FIRST SESSION

Monday, December 30, 9:00 to 12:00 M.

Wm. Salant: "The Influence of Temperature on the Toxicity of Caffein." Read by title.

Wm. Salant: "Further Observation on the Influence of Caffein on the Circulation." Read by title.

S. P. Beebe and Eleanor Van Alstyne: "The Effect of High Protein Diet on the Growth of Transplantable Tumors of the White Rat."

Lafayette B. Mendel and R. L. Kahn: "The Physiological Action of some Methyl Purines."

J. A. Eyster and W. J. Meek: "The Action of Certain Drugs on the Electrocardiogram."

Paul J. Hanzlik (by invitation): "The Intestinal Absorption of Alcohol."

Paul J. Hanzlik (by invitation): "The 'Toxic Dose' of Salicylates according to Clinical Statistics."

W. H. Brown and A. S. Loevenhart: "The Effect of Hematin upon the Circulation and Respiration."

Wm. De B. MacNider: "The Effect of Anesthetics on the Output of Urine in Uranium Nephritis."

George B. Roth: "The Physiological Assay of Aconitin."

#### SECOND SESSION

Monday, December 30, 2:00 P.M.

L. G. Rowntree and R. Fitz: "Renal Function in Experimental Passive Congestion."

R. Fitz and L. G. Rowntree: "The Effect of Temporary Occlusion of Renal Circulation on Renal Function."

Wm. W. Ford: "Observations on Three Poisonous Fungi not Previously Described."

J. D. Pilcher: "The Protective Action of Lipoids against Hemolysis."

Henry G. Barbour (by invitation): "The Action of Histamin upon Surviving Arteries."

George W. Crile and J. B. Austin: "Nitrous Oxide Sleep compared with Normal Sleep—Brain Cell Studies."

Wm. T. Porter and J. H. Pratt: "The Action of Diphtheria Toxin on the Vasomotor Center."

Hideyo Noguchi and J. Bronfenbrenner: "The Effects of certain Disinfectants and Therapeutic Preparations upon the Cultivated Spirochaetes." Read by title.

Frank M. Surface (by invitation): "The Effect of Surplus Cow Serum on Complement Fixation with Infectious Abortion."

I. Adler and C. L. Alsberg: "Studies upon the Long-continued Administration of Adrenalin and Nicotin." Read by title.

C. L. Alsberg: "The Hemolytic Power of Various Plants." Read by title.

#### THIRD SESSION

Tuesday, December 31, 9:00 to 12:00 M.

Yandell Henderson: "Demonstration of a Carbonator for Quantitative Carbon-dioxide Therapy." Read by title.

Paul Lewis: "Further Observations on the Relations of Vital Stains to the Tubercle."

T. S. Githens and S. J. Meltzer: "On the Course of the Toxic Effects of Ether and Chloroform under Intratracheal Insufflation."

T. S. Githens: "On the Influence of Decerebration upon Morphin Tetanus in Frogs."

I. S. Kleiner (by invitation): "On the Effect of Sodium Bicarbonate and Sodium Chloride upon the Convulsions produced by Heroin and Strychnin."

J. Auer and S. J. Meltzer: "The Influence of Pituitrin upon the Depressor Action of the Vagus Nerve in Cats."

B. T. Terry: "The Influence of Heat upon the Toxicity for Trypanosomes of Blood containing Transformed Atoxyl."

B. T. Terry: "Variations in the Toxicity of Transformed Atoxyl for Trypanosomes caused by Altering the Number of Organisms."

#### EXECUTIVE SESSIONS

The following officers were elected for the year 1913:

*President*—Torald Sollmann.

*Secretary*—John Auer.

*Treasurer*—A. S. Loevenhart.

*New Members of the Council*—J. J. Abel, Wm. de B. MacNider.

*Membership Committee*—C. W. Edmunds was reelected to serve three years, and the place made vacant by Dr. Sollmann's election to the presidency was filled by the election of Reid Hunt.

*New Members*—Among the candidates for membership investigated by the membership committee, the following were favorably reported to the council, recommended for election, and elected by the society: Henry Gray Barbour, Yale Medical School; Clyde Brooks, University of Pittsburgh; Cary Eggleston, Cornell Medical School; P. J. Hanzlik, Western Reserve Medical School; D. E. Jackson, Washington University; I. S. Kleiner, Rockefeller Institute; Oscar H. Plant, University of Pennsylvania; A. H. Ryan, University of Pittsburgh; Frank P. Underhill, Yale Medical School.

At the last business meeting the Pharmacological Society passed a vote of thanks to the Western Reserve University for the hospitality extended and to the local committee, Drs. Macleod, Sollmann and Pearce, for its thorough arrangement of all the details which made the Cleveland meeting so pleasant.

J. AUER,  
*Secretary*

#### THE TENNESSEE ACADEMY OF SCIENCE

THE second session of the first annual meeting of the Tennessee Academy of Science was held at Carnegie Library Hall, University of Tennessee, Knoxville, Tennessee, on November 29-30, 1912.

The following papers were given:

##### NOVEMBER 29: MORNING SESSION, 10 A.M.

"The Taste Sense in Frogs," Alice N. Porter.

"Hydrogen Peroxide as a Bleaching Agent for Entire Insects," E. C. Cotton.

"Relation of the State to its Water Power Resources," J. A. Switzer.

"The Recent Disturbance in the Northern Equatorial Belt of Jupiter" (read by Professor Porter), Latimer J. Wilson.

##### AFTERNOON SESSION, 2 P.M.

"The Effects of a Soy Bean Crop on a Following Cereal," Maurice Mulvania.

"The Fourth Dimension," Samuel M. Barton.

"The Occurrence of Aerial Roots on the Virginia Creeper," Samuel M. Bain.

"Micro-color Photography," Samuel M. Bain.

##### EVENING SESSION, 7:30 P.M.

Address by the retiring president, "Science and Progress in the South."

"The Mastodon and the Glacial Age" (illustrated), W. E. Myers.

Reception to visiting members by the faculty of the University of Tennessee.

##### NOVEMBER 30, 9:00 P.M.

"Defraction Phenomena Due to the Dimensions of the Source of Light," Brown Ayers.

"Studies in Feeding Habits of *Amæba*," Asa A. Schaeffer.

"The Slates of Georgia," T. Poole Maynard.

"The Importance of the Study of Meteorology in its relation to Agriculture," J. F. Voohees.

"The Breaking of the Nashville Reservoir, November 5, 1912" (illustrated), Wilbur A. Nelson.

"Types of Iron Ore Deposits in East Tennessee," C. H. Gordon.

The following officers were elected for the ensuing year:

*President*—Watson Selvage, University of the South, Sewanee.

*Vice-president*—G. A. Dyer, Vanderbilt University, Nashville.

*Secretary*—Wilbur A. Nelson, Tennessee Geological Survey, Nashville.



*Treasurer*—Samuel M. Barton, University of the South, Sewanee.

*Editor*—R. M. Ogden, University of Tennessee, Knoxville.

The following resolutions were passed on the conservation of Tennessee's water power and exhibits at the national expositions:

"WHEREAS, it is becoming increasingly evident that the water power of our state is becoming appropriated to corporate use and alienated, perhaps forever, from the control of the commonwealth, to the great detriment of this and future generations, we, the Tennessee Academy of Science, respectfully recommend to his excellency, the governor, and to the legislature of the state of Tennessee, the immediate passage of a law authorizing the governor to appoint a conservation commission which shall have power (1) to grant, under such restrictions as are hereinafter suggested, renewable franchises for a limited term, to all corporations desiring to make use of said water power; (2) to secure a permanent water supply, provide for the cooperation of the state in forestry conservation, and the eventual creation of a state forest reserve; (3) to prevent the diversion of the electric power derived from the natural waters of Tennessee to the enrichment of other states, and to encourage its utilization within our own borders, and to that end (4) to cooperate with the boards of trade and other civic bodies to secure the location of industrial plants in all localities where power is cheap and abundant, and (5) to assure a more permanent and lasting supply of cheap power throughout this state in all parts thereof, whether blessed with water power or not, by the prevention of waste in mining and use of coal.

"We further recommend that the commission be instructed to investigate the feasibility of a state-wide system of power conservation, development and transmission, whereby every section of the state may enjoy an equitable share of the benefit thereof; and that the commission report its findings to the next session of the legislature.

"We suggest further the appointment on said commission of a practical expert in each of the following departments of activity: hydro-electric engineering, forestry, mining and scientific business management.

"To these ends we recommend the enactment of legislation similar to that already in force in the states of New York and California, providing for the conservation of their natural resources."

"In view of the three great expositions which are to be held in the near future, viz., the National Conservation Exposition, Knoxville, Tenn., 1913, the National Exposition, San Diego, Cal., 1914, and the Panama Canal Exposition, San Francisco, 1915, the Tennessee Academy of Science, at its annual convention in Knoxville assembled, urges that the present session of the legislature should take immediate action to provide for an exhibit that shall properly and adequately set forth the resources of the state, especially in her water powers, her agricultural opportunities, her forests, her mineral wealth and her manufacturing advantages.

"It is suggested that an exhibit that could be used successively in the different expositions above named would advertise the state widely, without a proportionate cost, and would prove to be of extreme material value to the state."

Members from all sections of the state were present at this, the first annual meeting of the academy.

WILBUR A. NELSON,  
*Secretary*

CAPITOL ANNEX,  
NASHVILLE, TENN.

#### THE NEW YORK ACADEMY OF SCIENCES

THE academy and its affiliated societies held their annual dinner, Monday evening, December 16, at the Hotel Endicott. After the dinner, the annual meeting of the academy was held, at the conclusion of which Mr. Emerson McMillin gave his address as retiring president, in which, after reviewing the present condition of the academy as derived from conference with a large number of the men who have long been active in carrying on its various lines of work, he made several recommendations regarding the plans which might be adopted for enlarging the usefulness and interest of the organization and its meetings. The address will be printed in full in the concluding portion of Vol. 22 of the *Annals*. At the close of President McMillin's address, Mr. V. Stefánsson gave a most interesting summary account of the expedition which he and Dr. R. M. Anderson made along the arctic coast of western North America, from Point Barrow to Coronation Gulf, during the years 1908-12 inclusive. At the close of his lecture, Mr. Stefánsson outlined the plans of the second expedition which he is now organizing for geographical and ethnological work on Victoria, Banks and Prince Patricks Islands in the years

1913-16 inclusive, and indicated the manner in which his expedition and the Crocker Land Expedition will supplement each other's work.

The report of the corresponding secretary showed that the academy had lost by death, during the past year, the following honorary members: Sir George H. Darwin, elected 1899; Sir Joseph D. Hooker, elected 1907; M. Jules Poincaré, elected 1900; Geh. Rath Professor Ferdinand Zirkel, elected 1904.

At the meeting five honorary members were elected, namely: Professor Frank D. Adams, geologist, McGill University; Dr. George E. Hale, astronomer, Mt. Wilson, California; Professor Iliya Metchnikof, biologist and bacteriologist, Pasteur Institute, Paris; Sir John Murray, geographer and oceanographer, Edinburgh; Professor Sho Watasé, zoologist, Imperial University of Tokyo.

According to the report of the recording secretary, the academy held 8 business meetings and 26 sectional meetings during the year ending November 20, 1912, at which 65 stated papers were presented. Four public lectures were given at the American Museum of Natural History, to the members of the academy and its affiliated societies and their friends. The academy now has on its rolls 468 active members, including 22 associate members, 86 fellows, 90 life members and 11 patrons. There are in addition to this number, 20 non-resident members on the rolls. Announcement was made with regret of the loss by death of the following members: Messrs. John Jacob Astor, George Borup, Charles F. Cox, Morris Loeb, William Pennington, Edward Russ, John B. Smith, Isidor Strauss, James Terry and John Weir.

The treasurer's report showed receipts of \$7,648.17 and expenditures of \$6,092.66 during the fiscal year, including an investment of \$975, leaving a cash balance on hand November 30 of \$1,555.51.

The librarian reported that the library of the academy had received, through exchange and donation, 313 volumes and 1,670 numbers. Much of the effort made to complete imperfect files has been successful. The library has been open for the consultation of books every week-day from 9:30 A.M. to 5 P.M., and the use of the academy's books has increased noticeably.

The editor's report stated that pages 177-263 of Vol. XX. and pages 1-160 of Vol. XXI. had been distributed, and that pages 161-337 of the latter volume were now ready for distribution.

The annual election resulted in the choice of the following officers for the year 1913:

*President*—Emerson McMillin.

*Vice-presidents*—J. Edmund Woodman, W. D. Matthew, Charles Lane Poor, W. P. Montague.

*Corresponding Secretary*—Henry E. Crampton.

*Recording Secretary*—Edmund Otis Hovey.

*Treasurer*—Henry L. Doherty.

*Librarian*—Ralph W. Tower.

*Editor*—Edmund Otis Hovey.

*Councilors* (to serve 2 years)—Frederic A. Lucas and R. S. Woodworth.

*Members of the Finance Committee*—Emerson McMillin, Frederic S. Lee and George F. Kunz.

E. O. HOVEY,

*Recording Secretary*

### SOCIETIES AND ACADEMIES

#### THE HELMINTHOLOGICAL SOCIETY OF WASHINGTON

The thirteenth regular meeting of the society was held at the residence of Dr. Pfender, January 7, 1913, Dr. Pfender acting as host and Dr. Stiles as chairman.

The following were elected as corresponding members: American—C. C. Bass, Samuel T. Darling, W. B. Herms, George R. LaRue, Theobald Smith and Richard P. Strong; foreign—E. Brumpt, J. B. Cleland, Bruno Galli-Valerio, L. Gedoelst, B. Grassi, A. Henry, J. Ch. Huber, C. Janicki, T. H. Johnston, E. Loennberg, A. Mrázek, Wm. Nicoll, S. von Ratz and K. Wollfhuegel.

Mr. Hall presented the following note:

#### *A Spurious Parasite Reported as Trichinella.*

In 1905 and 1908 Staeubli published his method of examining blood for blood parasites. The method consists in adding 3 per cent. acetic acid to fresh blood in order to dissolve the erythrocytes and centrifuging to bring down the blood parasites. In his paper in 1908 he states that it will probably be possible to diagnose trichinosis in suspected human cases by examining blood from a finger or ear puncture instead of resorting to muscle excision.

Since then 3 cases of the finding of *Trichinella* by the use of Staeubli's method in human cases have been reported in the *Archives of Internal Medicine*. Herrick and Janeway (1909) reported a case from New York City in which *Trichinella* was recovered on two occasions in blood from the arm veins. Their specimens were passed on by Drs. Flexner and Oertel also, and judging from this and the photomicrograph they give, their findings should be accepted. Mercur and Barach



(1910) reported a second case from Pittsburgh. They state that the embryos correspond exactly to the one shown in Herrick and Janeway's illustration and their photomicrograph of a parasite from a gastrocnemius excision in the same patient is certainly one of *Trichinella*. Cross (1910) reported a third case from Minneapolis, in which the embryos are said to have been found in one cubic centimeter of blood from ear puncture. He gives a photomicrograph of one and states that two others "were not quite so clearly marked."

An examination of Cross's photomicrograph shows a straight body of homogeneous structure and quite devoid of internal granular or cellular bodies. Along the sides are two dark lines indicative of a high light refraction. This is probably a plant hair or some such object. The trash also shown in the photo indicates that Cross was not successful in guarding against contamination, as advised by Staebli, and the presence of plant hairs or similar objects under such conditions is what would be expected. The ratio of the length to the width of the object, which ought not to be greater than 26:1 for a *Trichinella* embryo in the blood, is about 36:1. These facts, taken in connection with Cross's statement that he found two other specimens which were not quite so clearly marked, indicate that Cross was dealing with plant hairs or some similar foreign bodies simulating *Trichinella*, and the case should not be retained as a case of *Trichinella* discovered in the circulating blood. The only clinical symptoms given—facial edema and a 44 per cent. eosinophilia—leave the case open as far as the existence of a trichinosis is concerned.

Dr. Ransom presented the following note:

*The Origin of some High Percentages of Cysticercosis in Cattle.*

In a note read before this society and published in *SCIENCE* for April 19, 1912, the writer called attention to some cases of infestation of cattle with *Cysticercus bovis* in which three lots of 251, 70 and 201 head had 25, 41 and 39 head, respectively, infested. These cattle were all from the same locality and an examination of the surroundings showed the following conditions, according to the report of Dr. Eagle, of the U. S. Bureau of Animal Industry: (1) the intake of the water supply for the cattle troughs was in a small river 75 yards below the outlet of the sewer from the city where the cattle were being fed; (2) in the cattle yard was a stagnant pool which was the only water the cattle had to drink when the

regular supply was frozen, as it frequently was during the winter, and this pool received the drainage from an area containing the privies of the establishment where the feeding was done and from part of the city where soil pollution existed; (3) the cattle were fed cotton seed hulls which were more or less contaminated with human feces, as it was a common practise of the employees of the establishment to defecate in the buildings where the hulls were stored. Such surroundings give almost perfect conditions for infestation with *Cysticercus bovis*.

Dr. Stiles presented the following notes on technique and treatment:

In centrifuging feces in fecal examinations, the State Board of Health of Kentucky, instead of using a centrifuge tube, is now using ordinary glass tubing, smoothed off at the ends after cutting to the length of the centrifuge tube. These tubes are corked at both ends. After centrifuging in the tube holder, the upper fluid is poured off and the sediment is taken out at the bottom by the removal of the cork, the cork being used in smearing the feces on the slide. Dr. Stiles has found this a very satisfactory proceeding, but states that on several occasions he has found eggs by the ordinary smear method in cases which were negative by the centrifuge method.

Judging from several cases in which it has been tried, the use of flowers of sulphur seems to be of promise in the treatment of infections with *Strongyloides stercoralis*. It also appears to be successful in the one case of flagellate diarrhea in which it has been used. This was a case with an excessive infestation, the stools being almost pure cultures of the flagellate. In hookworm infection flowers of sulphur has not been found of use. For hookworm the routine treatment which has been found most satisfactory consists in administering the thymol in three doses, instead of two, at 6:00, 7:00 and 8:00 A.M., followed by coffee at 9:00, Epsom salts at 10:00 and coffee and crackers at 10:30.

In addition to the humanitarian and medical points of view in the prosecution of the hookworm campaign, Dr. Stiles noted that the enormous waste of time, effort and expense in pregnancies that are to lead to children of inhibited development who will die before maturity as a result of hookworm disease, is a point that has made a considerable impression upon southern women.

MAURICE C. HALL,  
Secretary